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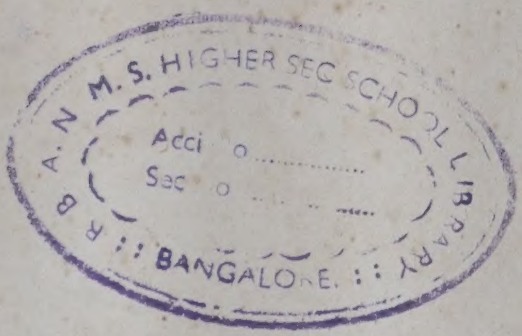

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# VEGETABLE OILS

# Peeps at Industries

By E. A. BROWNE, F.R.G.S.

*Volumes in this Series:*

PEEPS AT COCOA
PEEPS AT RUBBER
PEEPS AT SUGAR
PEEPS AT TEA
PEEPS AT VEGETABLE OILS

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COCONUT PALM IN MALAYA.

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PEEPS AT INDUSTRIES

# VEGETABLE OILS

BY

EDITH A. BROWNE, F.R.G.S.

AUTHOR OF
"SUGAR," "RUBBER," "TEA," AND "COCOA"
IN THE SAME SERIES

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# NOTE

It is astonishing how ignorant is the world as a whole of the great industries which maintain our oft-boasted civilization, and it is ignorance of this character which this series of books aims to dispel.

Produced on the same lines as the "Peeps at Many Lands" series, which has met with such remarkable success, these books will bring the reader into a complete understanding of all the great industries of the British Empire and the world at large. Technicalities being avoided, there are no impedimenta in the way of easy assimilation of the story and the romance of great manufactures. The reader is taken into the atmosphere and confronted with the stern realities of each industry, and when he has laid down the book he will find he has another window in his house to let in the sunshine of knowledge.

The reception accorded to the four previous volumes, concerned respectively with sugar, rubber, tea, and cocoa, has encouraged the belief that there is a wide sphere of usefulness, and power of pleasure-giving, for a series of Peeps at Industries written from first-hand knowledge. Like its predecessors, this peep at vegetable oils is a collection of experience, observation, information, and pictures harvested "on the spot."

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# VEGETABLE OILS

## CHAPTER I

### OUR PROGRAMME

CURIOSITY about the things we eat, drink, wear, or make use of in everyday life has brought us together again to make our plans for a round-the-world pleasure trip.

This is the fifth happy return of the day when I arranged the first of these wander tours with some of you, and we started off together to discover where sugar comes from, what it looks like in its natural state, and how its appearance is changed into a well-known guise. Since then we have visited rubber plantations, tea estates, and cocoa farms, ending up each tour with a round of factories where the natural products are transformed into familiar commodities.

To those of you who have enjoyed our previous parties well enough to join up again, I should like to express my appreciation of once more having you as travelling companions by telling you that I will do my best to see that you are not disappointed. To new friends I would just say, before outlining our programme and setting forth, that if any of you are dull or find the time long before we part company, the fault will be mine, for all that we are going off to see and do abounds in interest and amusement.

On the tour we are about to make we are going to see on the spot, in many different parts of the world, how vegetable oils are provided by nature, to get into touch with the life and customs of the many native tribes who take a leading part in producing supplies, to watch how such supplies are prepared for civilized use, and to find out for ourselves how much we owe of our health, happiness, comfort, and convenience to this whole industry and to everyone connected with it.

All vegetable oils, as their family name implies, have their origin in some form of plant life. They exist as hidden treasures in trees, shrubs, grasses, and other members of the vegetable kingdom.

There are many varieties of these oils, with different natures which respectively qualify them for service in special branches of manufacture. In recent years they have rapidly risen to a position of the highest commercial importance owing to a shortage of animal fats, such as beef tallow and mutton tallow, which they now replace or supplement on a very large scale in the making of soap, candles, and margarine. Thanks to the progressive ideals of our days, whereby it has become widely recognized that godliness comes next to cleanliness in the inverted order of the old-time plea for hygiene, a few people who were wide awake to the growing demand for soap began to develop the possibilities of using vegetable oils to raise the world's soap supplies from the low level of luxury to the popular heights of necessity. The pioneers also foresaw a dearth of other manufactured articles, as threatened by progressive ideals of a comfortable standard of living. For instance, anticipating a demand that would outstrip dairy butter supplies, they set to work

to develop the possibilities of using vegetable oils for making margarine, and to produce vegetable butters suitable both for cakes and pastry and for general consumption by strict vegetarians.

But for the commercial development of vegetable oils, you and I and millions of people to-day would be short of soap, limited in our enjoyment of its attendant health-giving pleasures of clean bodies and clean clothes. Cakes and pastries, too, would cost too dear to be, as they are now, part of the everyday fare in even quite humble households. We should all feel the pinch, too, in the available supply of many other commodities which, thanks to vegetable oils, are now so easily obtainable that most people forget to appreciate them, and imagine they just grow or are found somewhere in the colour, shape, and form in which they are sold in shops.

It is with a particular purpose that I have been laying stress for a few minutes on two of the principal articles made with vegetable oils. As soap and margarine are such very commonly known commodities, I hope our little preliminary talk about them will have made you feel very much at home with the general aim of our coming tour. Vegetable oils play an important part, as we shall see, in the production of many other necessities of present-day life, as well as of certain popular luxuries. Suffice for the moment to introduce you to a few of them by name: salad oil, glycerine, candles, lubricating greases, paints, varnishes, hair oil and other toilet accessories, grease paints for theatrical make-up, perfumes, and numerous medicaments, including healing ointments and castor oil.

Among the principal sources of vegetable oils are

the fruit of the oil palm; ground nuts, known in England as monkey nuts and in America as pea-nuts; coconuts; cotton seed; linseed, which is to say, the seeds of the flax plant; and for perfumery, such sweet-scented plants as lavender, thyme, and rosemary. There are many other sources of supply, but as they have less familiar names, I will wait to introduce you to them until we go amongst them.

Now we must pack our kit for a long stay in far distant lands. We shall need clothes for all climes, but more especially a generous supply of light summer garments suitable for the tropics, as we shall be spending much of our time in the sunny countries of Africa and the Far East.

Our first destination is West Africa, the homeland of the oil-palm. We are travelling out there by the same steamer that took us to the Gold Coast, on our last trip, to visit the cocoa farms. This time, though, we are not breaking the journey at Accra, but going straight on to Lagos, the capital of Nigeria, rather more than a fortnight's voyage from Liverpool.

## CHAPTER II

### IN AN OIL-PALM FOREST

Only three weeks ago we were just leaving home, and here we are to-day in a West African oil-palm forest. Still more extraordinary, about half an hour ago we were in the up-to-date busy town of Lagos, among fine public buildings, big trading stores, banks, offices, and magnificent houses, in streets where numbers of

white men and women were walking or motoring, and where there were policemen on duty to regulate the traffic. Now, after a twenty minutes' run by car and a few minutes' walk, we are so much in the wilds that we might be hundreds of miles away from any centre of civilization.

In every direction we look we see oil-palms, of all ages and sizes, from baby seedlings to veterans of forty to fifty feet high.

Where we are there is no sign of a habitation, not so much as a trail to suggest we might discover somebody living somewhere in this wilderness if we tramped on far enough to find him.

There are similar dense forests of wild oil-palms, covering millions of acres, throughout West Africa: in Liberia; Gambia, Sierra Leone, Gold Coast, and Nigeria (British Possessions); Senegal, Guinea, Gaboon, French Congo, Dahomey, and Ivory Coast (French Possessions); the Belgian Congo; Togoland and the Cameroons (formerly German Colonies and now in Anglo-French occupation); and Portuguese West Africa. The countries I have just mentioned are, up to the present, the great commercial sources of palm product supplies, the most extensive forests usually being in the moist coastal regions and along the banks or in the hinterland of rivers. The oil-palm, however, also occurs in the West Indies, Mexico, and in the South American countries of Brazil and Guiana; and it has been introduced into the Far East.

The trees by which we are surrounded are botanically known as *Elæis guineensis;* they are related to the coconut tree, belonging to the same tribe of palms. There are several varieties of Elæis in West Africa,

where they are respectively dignified by special native names such as Abe-pa and Abe-bobe, which differ Babel fashion according to the widely varying languages and dialects of the numerous native races and tribes. From a commercial standpoint, it has so far only been considered important to group these different native varieties of Elæis into two classes, those with a hard-shelled stone or seed, and those with a thin, fine-shelled seed. As far as investigations have been pursued, the thin-shelled variety has been found to be the more generous oil giver.

We are wandering along at random amidst an undergrowth of young palms, in the shadow of the great plume-like branches which crown the heights of the bigger trees. Several times we have kicked against something, and on looking down have seen near our feet a number of little blackish-brown objects that seem to be some strange kind of nut. These are the stones of palm fruit. Look up into the crown of some of the bigger trees; there you see the fruit growing in large bunches, or, as they are called, "fruiting heads."

Monkeys and birds eat the fruit, and drop the stones, maybe at some distance away from where they collected their feast. Or the ripe fruit falls to the ground and rots away, leaving the stones lying about, to remain where they were deposited, or to be scattered helter-skelter by the passage of wild animals, or to be kicked in some direction or another by a human being straying in their midst—such human being is more likely, of course, to be a darkie than a pale-face like ourselves. By such ways old oil-palm forests are replenished and new areas brought into existence, for each of the stones contains a kernel or seed. Pick up

some of the stones, examine them carefully, and you will see what wonder-works of nature they are. They have eyes like their relative the coconut. There are three of them, two closed for some good purpose doubtless, but that is one of nature's secrets which man has not yet discovered; the third is open, to provide an easy outlet for the germ.

Young oil-palms have a thick stem, which throws out ring-like series of long feathery leaf fronds. As the tree grows up, the trunk becomes narrower but more regular in form; the lower series of leaves drop off, leaving their bases to encircle the trunk with indistinct ring streaks; and the higher series group themselves into a tuft or crown, which flowers and fruits. Individual trees usually bear both male and female flowers, although the natives say there are some trees which only produce male flowers and consequently no fruit. The male flowers grow in bunches of tassel-like pendants; usually there are three of these bunches paying court to the female inflorescence.

The trees begin to fruit when they are five or six years old, but at this early age they only produce three or four heads of small dimensions. Adult trees yield on an average from four to eight heads, each weighing about thirty pounds and containing about twelve hundred fruits. Specially strong grown-ups may give an annual yield of ten, twelve, or even twenty giant heads, some measuring more than half a yard long and a yard round and weighing as much as a hundredweight. Oil-palms have a long prime-of-life period which lasts until they are about forty years old; then their fruit-bearing powers diminish, slowly at first, but later on more perceptibly. There are two fruiting

seasons, corresponding with the rainy season and the dry season. The rainy weather crop is usually the lighter. The average height of fully grown oil-palms is from thirty to fifty feet, although some have been known to reach a hundred feet. The average limit of old age is from sixty to seventy-five years, but there are many record-breaking veterans, and nobody knows how old they are.

Suddenly we have struck a narrow trail, and in the distance we espy some huts. Away yonder in the forest we notice a black man, who seems to be performing an extraordinary climbing trick. Leaving the trail, we strike off at a tangent to the attractive scene of a native gymnastic display. A few minutes later we are excitedly watching one of the hundreds upon hundreds of natives who climb the oil-palms of the African forests to collect their rich harvest of fruiting heads. They are all highly skilled artistes, these climbers, superstitious and moody about their calling. They hold an important communal position, since every member of their respective tribe, from the Chief downwards, is primarily dependent on their labours for the most popular and nourishing form of daily food, and for the wherewithal to buy cloth, beads, and anything else he may fancy.

You see how it is done ? The climber uses a rope sling, which goes round both the tree-trunk and his waist. By skilfully hitching up the part round the trunk and moving up his feet to a corresponding distance, he scales the tree as though he were walking up it at racing pace. On reaching the crown he slashes off some dead leaves that are blocking the way to the stem of a ripe head of fruit. With a further wield of

(*a*) HOW OIL PALM FRUIT GROWS.

(*b*) SEPARATING HEADS OF OIL PALM FRUIT.

his cutlass he severs the stem, and the head comes tumbling to the ground. He is standing alongside it well within ten minutes of the start of the whole performance.

## CHAPTER III

### PREPARING PALM OIL

PALM fruit yields two kinds of oil, PALM OIL and PALM KERNEL OIL. To see how they are prepared we must first carefully examine the fruit.

Fresh heads, such as we have just seen harvested, are at first sight rather like a pine-apple in general appearance. They contain, as we already know, a large number of fruits. Each fruit is partially embedded in a husk-like covering. Remove one from its snug quarters and you find it is somewhat conical in shape, tapering abruptly to a point, and has a smooth, yellowish-red skin with a black apex. By the way, the colour may vary from bright orange-red to pale yellow that is nearly white. Pick the fruit to pieces—your hands become very oily in the process—and you discover that beneath the thin skin there is a thick, fibrous layer containing one of those blackish-brown stones with which you are already familiar. The fibrous portion, included in what is botanically known as the *pericarp*, contains Palm Oil. Within the stone there is a white-fleshed kernel, the source of Palm Kernel Oil.

We are first going to see how Palm Oil is prepared.

We follow some darkie carriers who are taking heads

of fruit in the direction of those huts we saw a little time ago. Naturally we stop, when they do so to deposit their loads in a clearing. Immediately we are surrounded by a crowd of very friendly but highly inquisitive darkie women, who paw our clothes and chatter to us nineteen to the dozen in a strange language, and pretty little pikaninnies, clad in a string of beads, who stare at us with their big dark eyes, and seem to be even more astonished to meet us than we were to come across one of their brethren walking up a tree.

Looking round, we find we are in the compound, or common bush yard, of a native village. In one part of the open space there are piles of palm heads in different stages of drying. As the result of exposure to the sun for a few days the fruits shrink, consequently they are more easily dislodged. They are separated by a shaking or beating, or broken out by hand.

Near by the drying patch you notice some rough, leaf-lined pits. Crowded together in these are separated fruits, which lie buried under a palm leaf coverlet for several days; thus decomposition is set up, making the fibrous pulp inclined to become detached from the stone.

You see those women over yonder attending to primitive earthenware cooking-pots standing on a camp fire? No, they are not preparing a family meal, they are looking after a boiling of fruit from the pits; cooking makes it tender, and still more amenable to the next stage of treatment.

The boiled fruit is left in the pots to cool, after which it is turned out into a shallow, oblong vat.

A few steps bring us alongside one of these vats, in

which a man is standing. It is a roughly made wooden receptacle, sunk in a hole in the ground. In it is a heaving of fruit from which the man is stamping out the oil with his bare feet. With each hand he holds on to a long stick, the lower end of each stick pressing on the ground outside the edge of the vat. By thus supporting himself he has more power to stamp, and is better able to prevent his feet from slipping and immersing him in the oily mass he is treading.

After the fruit has thus been well pounded it is left in the vat overnight. At this stage it is a thick fibrous pulp. The oil which drains out during the night goes into a gutter, and thence to an adjoining hole in the ground. Next morning women and children scoop out the pulp with their hands, and squeeze the oil from it. After each such performance there remains a ball of oily-damp fibre and stones. These are separated and spread on the ground to dry. The dried stones are cracked by hand, as we shall see presently. The dried fibre makes an excellent fire-lighter, and any that is not required by its owners for this purpose is made up by them into balls, or twisted round a stick, to be sold in Lagos, the nearest town.

The oil is put in pots, boiled and well clarified by skimming and straining. The palm oil prepared by the primitive methods, such as we have been watching in this little village, is uniformly clean and of particularly good quality. It is classed as "Lagos fine grade."

Throughout West Africa the general principle of extracting palm oil is the same, but the methods employed vary considerably according to locality. Thus,

round Ibadan, some hundred and twenty miles north of Lagos, the boiled fruits are put in wooden mortars made of hollowed tree trunks, and pounded with long poles, which are just sturdy branches of trees. The fibrous mass resulting from this treatment is then thrown into a pit, which is to say a big, shallow hole in the ground, and covered with about a foot and a half of cold water. Women wade into the pit and jump about to express the oil from its messy contents—they look as if they were playing some extraordinary water-game, or indulging in a mud-bath "cure." After this performance the contents of the pit are left to themselves for a little time, and the expressed oil, being lighter than water, naturally rises to the surface. The women then skim off the oil and strain it through a basket, after which it is further separated from the water by boiling. The oil thus prepared is of inferior quality to that we have seen being made ready for market in the little village we are visiting near Lagos.

Oil-palm fruits vary in size and weight, according to the variety of the tree from which they are obtained, and there is a considerable difference in the relative weight of pulp and nut contents. Some, for instance, contain 30 per cent. pulp and 70 per cent. nut, others about 50 per cent. pulp and 50 per cent. nut. The maximum yield of palm oil obtainable from the pulp averages about 56 per cent., but by their primitive methods of extraction the natives only obtain about half the possible yield.

## CHAPTER IV

### THANK YOU, SAMBO

THERE are many more amusing and interesting daily doings in course of progress at this village we have struck. They are typical of what is going on day after day, week after week, year in and year out, in the vast oil-palm forests of West Africa—so let us stay a little longer in our present surroundings, for by so doing we shall glean a good idea of how much we owe to the darkie natives in connection with palm products.

Here is a young girl cracking palm-fruit stones, or nuts as they are often called. Her "nutcrackers" consist of a couple of stones; one, a thin flat little slab-like bit, rests on the ground in front of where she is sitting, the other, which is a pebble, she holds in one hand. As she cracks the nuts with the pebble, she uses her other hand to separate the kernels from the broken shells. She works with such lightning rapidity that before we can follow her movements we have to ask her to go very slowly for our special benefit.

You are wondering how many nuts can be cracked in a given time by this primitive method. The answer to this question was given at a competition, when quite a young girl produced a pound weight of clean kernels in a quarter of an hour—that is to say, kernels separated from the shell. In other words, an adept cracker can produce a hundredweight of clean kernels in four days if she works hard for seven hours a day.

This is the common method of cracking palm nuts as practised by the natives throughout West Africa. Together they crack in this way several hundred

thousand millions of single nuts every year, thus producing an annual output of hundreds of thousands of tons of kernels.

Palm kernels contain a high percentage—from 45 to 50 per cent.—of superior quality oil, known as Palm Kernel Oil. The hard little kernels are difficult to crush with primitive appliances, so the natives only prepare a small amount of palm kernel oil, and this they use themselves for cooking purposes. The bulk of the vast quantities of kernels produced is exported, for the oil to be extracted by the aid of machinery or chemicals. The biggest importers of palm kernels in these days are the United Kingdom, France, and Holland. Later on in our trip we shall be visiting some seed crushing mills, and making a close acquaintance with up-to-date ways of vegetable oil extraction. We shall then see how the residual meal left after the oil has been taken from palm kernels is made into cattle cake, a valuable feeding stuff for livestock. Many efforts have been made to popularize in West Africa some very good, specially designed nut-cracking machines; but the natives have shown a decided preference for the hand and stone way of cracking, as practised by their ancestors from time immemorial.

Further excitement is provided for us in the compound by a little party of women and children setting out to sell their village-made palm oil. The oil is going to market in narrow-necked gourds stoppered with grass, old bottles, and battered kerosene tins, which the carriers are balancing on their heads. It will be taken to the nearest trading centre, which happens in this case to be Lagos, and sold direct to the European traders there, or to brother natives who act

as middlemen between the darkie producers and the white buyers. Palm kernels are disposed of in a similar way, the carriers conveying to market head-loads of them packed in baskets or bits of cotton cloth. When the nearest trading centre is accessible by water, any old makeshift receptacles filled with palm oil are taken to market by boat, and the kernels travel loose with them.

The whole history of West Africa onwards from the fifteenth century is bound up with the coming of the white man—Portuguese, Dutch, Danes, English, French, and Belgians—to trade with the natives. The nations which are now established there as ruling Powers are all commercially represented by a large trading community. Most of the traders in these days are big companies with European headquarters, and numbers of "factories" located in towns and village centres, usually within the political boundaries of their parent country's West African territory. A "factory," in the West African meaning of the word, is a combination of depôt for the purchase and storage of native produce; shop for the sale of goods that appeal to the darkie's taste and fancy, notably cotton cloth, salt, and beads; and living quarters for the white man in charge, representing the Company to whom the factory belongs.

Whilst we have been sightseeing and talking, mammies have been busy preparing a meal. Supper time has come. Grown-ups and pikaninnies squat themselves down on the ground in circles, round big calabash-bowls full of slices of boiled yam immersed in palm oil. Yams are a popular vegetable, rather like floury potatoes. Men, women, and children all use their

fingers, which were made, as you know, before forks, to pick out the pieces of yam, to swish them round in the bowl so as to gather up a generous supply of palm oil, and to convey their helping of the feast to their hungry mouths.

Vast amounts of palm oil are consumed by the natives. It is estimated that in Nigeria alone they eat about 3,500,000 hundredweights every year. You think you would not care to eat palm oil ? Wait until you have been in West Africa a little longer, and you will be looking forward to Palm Oil Chop as a Sunday treat. It is a highly popular and luxurious European version of native fare, consisting of boiled chicken and vegetable roly-poly served in palm oil sauce.

Leaving our bush friends of this little village to finish their supper, we bid them farewell and start back on our journey to Lagos. As we walk through the forest to the roadside spot where we left our car, let us make a rough estimate of the white man's debt to the darkies of the oil-palm forests.

West African natives discovered the existence of palm oil and palm kernel oil, found out for themselves ways of extracting and preparing these two forest products, and further found out by enterprising experiments that these products were tasty and nutritious food supplies, useful also for burning as a source of light, and very good for many other purposes, such as cleaning their bodies and making them shine for festive occasions.

From native uses of palm products the white man took hints for bringing palm oil and palm kernel oil into service to increase the comforts, conveniences, and luxuries of civilized life. Palm oil is now used

BELGIAN CONGO NATIVES PREPARING PALM OIL.

CRACKING PALM NUTS.

commercially on a very large scale for the manufacture of soap, candles, and glycerine; palm kernel oil for margarine, bakery fats, and vegetarian "butters."

The natives produce a very large proportion of the palm oil and palm kernels exported annually from West Africa for use in European factories—an expert pre-war estimate put the annual total at 125,000 tons palm oil and 325,000 tons kernels. They work the oil-palm forests on a family or communal basis, which is the root of their whole social system.

The West African family is a community of far-reaching relationships, embracing father, who is a more or less important Chief, the several mothers who are his wives, every mother's children, grandparents, grandchildren, uncles, aunts, nieces, nephews, cousins, various other dependents and, in the case of big Chiefs, a number of retainers. According to native laws and customs, the oil-palm forests belong to the ruling Chiefs for their lifetime, to be held in trust by them for their people. The paramount Chiefs allow their petty Chiefs to work certain oil-palm areas in consideration of payment consisting of a certain proportion of the palm oil and kernels produced. The petty Chiefs sublet on the same terms to other petty Chiefs lower down in the social scale, and so the subletting goes on over and over again. Thus, fathers or heads of innumerable families have proprietary rights over certain areas of palm forest. They all work their districts with a family labour force, the women and children doing, as we have seen, a large share. The centres of operations are mostly widely scattered small villages, such as we have just been visiting, collections of oblong-shaped, palm-thatched mud huts enclosed in a stockade.

## CHAPTER V

### NEW WAYS OF WORKING PALM FORESTS

Generally speaking, the oil-palm forests throughout West Africa belong to the natives, and are worked by them on the family or communal system in the primitive way we have seen.

There are a few striking exceptions to this rule, due to the white man's introduction of modern industrial methods. We are going to the Belgian Congo to see vast stretches of wild, primeval oil-palm forests transformed into orderly groves, served by roads and railways for simplifying transport; to visit oil-palm plantations that have been scientifically reared from selected seedlings; to watch up-to-date machinery extracting palm oil and cracking palm nuts. En route, I will tell you the story of how a British pioneer set the example of bringing about such remarkable changes.

Not many years ago a few people in various parts of the world began to prophesy that there would soon be a shortage of vegetable oils unless steps were taken to increase the supply. The prophets were practical men with an intimate first-hand knowledge of their subject; agricultural and forestry experts living in far away lands of actual and potential supplies of vegetable oil products, but in touch with manufacturers using these raw materials, and *vice versa*. They were alive, too, to the progressive phases of modern civilization, such as a rapidly increasing interest in hygiene, which pointed to a growing demand for soap. The majority of them, however, found they were powerless to pursue

HEADS OF PALM FRUIT, ALBERTA, BELGIAN CONGO.

any plans for avoiding the industrial handicap they foresaw, together with its attendant discomforts and inconveniences. Just at the time when the vegetable oil campaign was started, the price of rubber was soaring higher and higher, and a feverishly excited public was on the verge of making that historic run on rubber shares known as the Rubber Boom. There was no interest or money available for anything but rubber, and afterwards, when the slump came, people were not in the mood to listen to golden stories about the fortunes to be made by backing another tropical industry.

It happened, though, that one of the people who anticipated a shortage of vegetable oils, unless something were done, and done quickly, was a manufacturer whose career had already entitled him to rank as a captain of industry. Sir William Lever, now Viscount Leverhulme, could afford to back his own judgment. At the request of the Belgian Government he sent out an expedition in 1910 to prospect likely districts in the Belgian Congo, his far-sighted aim being to ensure to his vast soap-works at Port Sunlight, and to other of his enterprises, a regular and sufficient supply of palm products to keep pace with manufacturing activities and a progressive policy for their development.

Up to that time the Belgian Congo had only been exporting to Europe a small quantity of palm oil and palm kernels, and the entire output came from the Lower Congo, in the neighbourhood of the coast. The expedition journeyed to the upper reaches of the Congo and into the far interior, locating vast stretches of oil-palm forests, whose existence had not been dreamed of by white men who had been living close by

them for years. A form of Convention with the Belgian Government was then drawn up, and Sir William Lever sent out a specially chosen representative to verify the information brought home by the original expedition. On April 14, 1911, the Convention was signed, and almost immediately a Company, known as La Société Anonyme des Huileries du Congo Belge, with head offices in Brussels, was formed under Sir William Lever's presidency to work the land concessions of about 750,000 acres granted by the Belgian Government. During 1912, Sir William, accompanied by Lady Lever and others, visited the oil palm forests and other areas included in these concessions.

Lord Leverhulme's scheme for the development of the concessions was put in hand immediately after the signing of the Convention, but the real progress took place after he personally had been able to visit the Congo and organize development on the spot.

We have come to the Belgian Congo to see what the Huileries du Congo Belge has achieved in the comparatively short period of thirteen years since its foundation, and under the continued presidency of its founder.

In an ocean liner we have travelled nearly a hundred miles up the mouth of the Congo River to the port of Matadi, the farthest point inland to which such big vessels can proceed. From Matadi we continue our journey by train, travelling for two days on a Government line of railway to Kinshasha, on the main stream of the Congo.

Kinshasha is the African headquarters of the Huileries du Congo Belge. The oil-palm forests owned by the Company are many hundred miles farther away in the

interior. They are all favourably situated in the neighbourhood of navigable waterways, some being served by the main stream of the Congo as highway of communication, others by its broad tributaries. By the way, Kinshasha has recently been renamed Leopoldville, and, in conjunction with its neighbour of that name, decreed the capital of the Belgian Congo; but it is still referred to commercially as Kinshasha.

A trip of about five days on a river steamer brings us to the nearest of these concessions; later on, we shall spend from a week to a fortnight on board when going up to the more remote grants.

Five concessions, each covering many thousand acres, have been opened up in different districts. Their respective centres are Leverville, Brabanta, Flandria, Alberta, and Elisabetha, all now of sufficient importance to be marked on any up-to-date map of the Belgian Congo.

Each concession is worked on the same policy, and to see what this means we have come to Alberta.

## CHAPTER VI

### NEW WAYS OF WORKING PALM FORESTS (*continued*)

The riverside bush station of Alberta is an oasis of civilization in the heart of the Congo wilds.

We are met at the landing-stage by the District Manager of the Huileries du Congo Belge, a fellow-countryman who gives us a hearty welcome, takes us to his bungalow residence, and introduces us to the pleasant, spacious quarters which he has generously allotted to us for our stay. Smart-looking negro boys

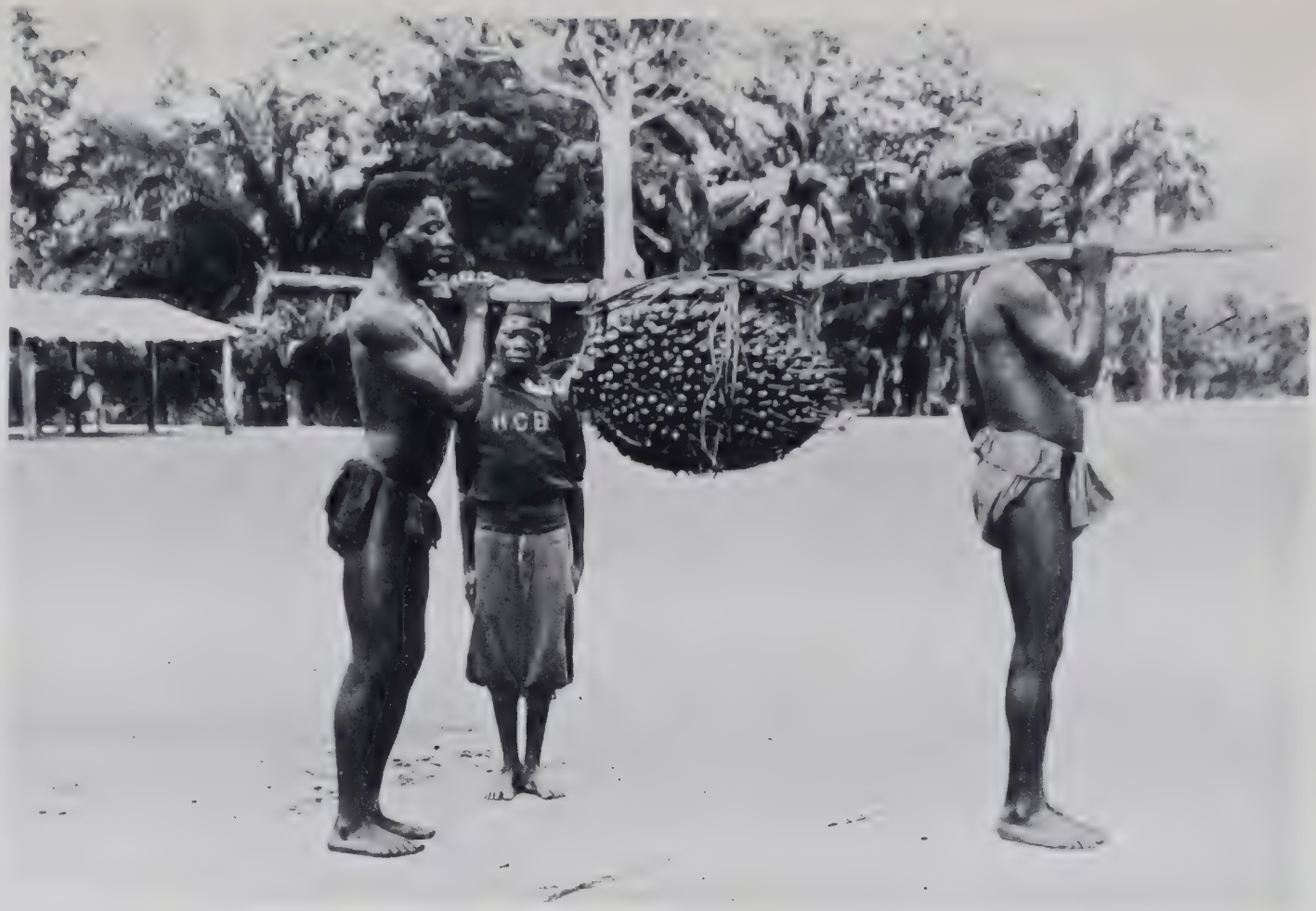
in H.C.B. uniform arrive with our luggage, and by the time we have unpacked and had a meal with our host we are feeling quite at home in the atmosphere and surroundings of a very comfortable country house.

The afternoon slips by in a flash, so interested are we in all we see during our preliminary tour of factory, workshops, oil storage tanks, native compounds, hospital, schools, and railway station.

Next day we are up before the sun, ready to take fullest advantage of the less broiling hours of the early morning for the first stages of a long journey. The concession of which Alberta is the local headquarters embraces an area of several thousand acres, containing many square miles of oil-palm forests occurring in belts. These oil-palm belts are separated from each other sometimes by stretches of open country, sometimes by forests of other trees. In company with a load of empty baskets we set forth on a train which is going back to the palm-belts to fetch a further consignment of fruit.

The railway along which we travel was built for the express commercial purpose of providing means of transport between the outlying palm regions and the riverside factory. So enchanted are we by the luxurious beauty of the scenery through which we pass, that we forget it is for business reasons the track runs through the heart of tropical jungle-lands. We are disappointed at being called to earth from dreamland by a shrill whistle—a few moments later the train pulls up in mid-forest to set us down and deposit a batch of returned empties.

How puzzling is the scene which unfolds itself as we start off to walk along a well-beaten trail! There



PALM FRUIT CARRIERS.

are oil-palms all round us, and each step we take brings more oil-palms into view; but instead of being jumbled together thicket fashion, as we have been accustomed to see them, the trees are standing well free from each other in orderly array at six to seven yards apart.

Is this a plantation ? we ask.

Our host tells us that he will be taking us to an oil palm plantation presently, but that just now we are in a natural forest which has been reclaimed from its primitive state. Numbers of old, poor-yielding palms have been cut out, so as to provide better conditions for trees in the prime of fruit-bearing, and for young ones growing up to take their place in a scheme of sound commercial exploitation.

In this improved palm grove we notice that the heads of fruit are harvested by native climbers, as in other forests we have visited. But instead of being carried away for further treatment to the neighbourhood of a native village, they are taken to a distributing shed; there are numbers of these receiving centres within this big belt of palm forest we are visiting. Here the heads are left for a while to dry, after which the fruits are picked or shaken free.

The fruit is packed in baskets and taken down to the mid-forest railway. It goes on by train to the factory in Alberta, where machinery reduces it to a pulp and liberates its palm oil contents. The nuts, now also free, are mechanically transported to another machine which cracks them. The oil is pumped into storage tanks, to await the regular arrival of one of the Company's tank river-boats. When the steamer comes alongside, the oil is pumped into it and taken in bulk to Kinshasha. Here it is pumped into huge

storage tanks, from which it is transferred in due course into barrels. The barrels of palm oil go by rail to Matadi, whence they make the journey on an ocean-going cargo boat to Liverpool for Port Sunlight, or to Antwerp for delivery to some other factory associated with the parent enterprise of Lever Brothers.

The kernels are packed in sacks for their overseas journey to a British or Continental port. Most of them are sold on the open market, to be sent to mills specially equipped with seed-crushing machinery.

By the up-to-date mechanical method of extracting the oil from palm fruit, as employed at all the factories of the Huileries du Congo Belge, an oil of very much finer quality is obtained than that commonly made by the natives themselves. Further, a high percentage of oil is recovered, whereby a great economy is effected over the wasteful native methods.

## CHAPTER VII

### NEW WAYS OF WORKING PALM FORESTS (*continued*)

Our next excursion is to one of the H.C.B. oil-palm plantations, a large estate in the Alberta district. At first sight it is reminiscent of well-managed rubber and tea estates in the East, and on closer acquaintance we find that it has been developed under European management on similar lines. The trees have been reared from selected seedlings and planted at regular intervals apart on a well-prepared clearing. The plantation is systematically cultivated by trained

(*a*) PALM FRUIT TRAIN, ALBERTA AREA, BELGIAN CONGO.

(*b*) PALM OIL STORAGE TANKS OF THE HUILERIES DU CONGO BELGE, KINSHASHA.

agriculturists. Transport is facilitated by broad main roads and by side paths linking them up with the trees.

There are many great advantages in using plantation methods with oil-palms. Economy in harvesting the fruit heads, for example. The trees, as we know, begin to bear when they are five or six years old. If young palms of about two or three years old are transferred from the forest to a plantation, they will begin to yield about three years after they have been in their new quarters. They are then very low, and the heads of fruit, being only two or three feet from the ground, are within easy reach for cutting. For some fifteen years longer the fruit will remain accessible with the help of a short ladder. For all this time the planter is independent of the skilled climber, who alone can scale thirty to fifty feet high trees, and who does not care to go aloft in the rainy season, when the trunks are very slippery.

Again, cost of production can be cut down considerably by provision of transport facilities. It takes less time to carry the fruit between any two points on a well-made path than to convey it the same distance along a rough bush trail. Broad main roads, suitable for mechanical transport, are a still greater economy of time, and soon more than pay for the cost of construction by reducing the wages bill of carriers. Those of you who came with me to West Africa three years ago to visit the cocoa districts saw for yourselves how much the Gold Coast cocoa industry owes to the opening up of roads and the development of motor transport. Steam wagons are being used on some of the Belgian Congo plantations, and a few light motor lorries have been imported as a practical measure for

studying the possibilities of such means of industrial transport in relation to local conditions. The running cost of these lorries is high, as kerosene or petrol is very expensive by the time it reaches Central Africa. It is hoped, however, to use palm oil, cheap and on the spot, as motor fuel, and experiments are being made to this end; the outlook is promising, for already some of the Congo river-boats run on palm oil.

From the H.C.B.'s Alberta concession, cleared areas, and plantations we carry away outstanding memories of a system of progressive efficiency, in which the workers' interests are not only studied as a prime factor of commercial success, but cared for in the spirit of good-fellowship. Such memories are intensified by our sojourn on other of the Company's concessions and by our stay at the Kinshasha headquarters. Each concession has a European manager and staff, and a negro labour force. The labourers are paid, housed, fed, and clothed, their children are educated free, and in case of sickness they and their families receive skilled medical attention. On the staff of the well-equipped hospitals there are specialists for that dread scourge of the Congo, sleeping sickness.

Following the example of the Huileries du Congo Belge, several companies, operating on a smaller scale, are now working concessions in the Belgian Congo by partially clearing palm forests and by establishing palm plantations. Some of the more enlightened of the native Chiefs, too, have increased their output of palm products by copying the white man in such matters as path and road making, and some have even started planting.

The merest glance at a few figures will help you to

appreciate the combined result of the impetus given by pioneer enterprise. Between 1887 and 1914 the annual export of palm oil from the Belgian Congo never exceeded 2,500 tons; the highest figure for palm kernels was about 8,000 tons, the annual average being considerably lower, in the neighbourhood of 4,000 tons. Onwards from 1914 there has been a markedly rapid increase; for instance, in 1920 the export of palm oil was about 8,000 tons, and of palm kernels something like 39,000 tons.

The oil-palm has been introduced into the East in recent years, and is being cultivated with particularly promising results in Sumatra, Dutch East Indies. A considerable area on the east coast of Sumatra has already been planted up with the crop, a programme of vast extensions is being energetically carried out, and it is calculated that within the next ten or fifteen years the export of palm oil from that island will have reached the stupendous total of 100,000 tons, which is very near the estimated pre-war total of 125,000 tons from all West Africa. The estates are being scientifically developed upon results obtained at the east coast Experimental Station at Medan, world-famous under a title derived from the initials of its Dutch name, A.V.R.O.S., and with the advice of experts who are at the head of their profession. Evidence to date goes to prove that cultivated oil-palms in Sumatra give a higher production than their indigenous relatives in West Africa, and that it is possible for Sumatra palm oil to equal in quality the best African palm oil on the market. The aim of all connected with this new industry in the Dutch East Indies is to standardize the entire Sumatra output on a best-quality basis.

It looks very much as if the Dutch in Sumatra are well on the way to making history with a revolution of the oil-palm industry, similar to the British revolution of the rubber industry which followed on the pioneer planting of rubber in Ceylon and Malaya. Such a possibility adds very much to our interest in pioneer British efforts, such as we have been seeing in the Belgian Congo, to meet new conditions of competition.

## CHAPTER VIII

### MONKEY NUTS BY ANOTHER NAME

ALL of you must know the look and taste of monkey nuts, and I expect that many of you, in common with the majority of English people, are inclined to scoff at them a bit as food for the wild animals after which they are nicknamed.

In the commercial world, however, these nuts rank among the most valuable sources of edible oil, and the various names by which they are called command respect. For instance, in France they are known as *Arachides*, which is a derivative of their botanical name *Arachis hypogœa*. All British people who are sufficiently well acquainted with their utility to appreciate them call them GROUND NUTS, and as we are about to discover for ourselves their worth, that is the name by which we will speak of them during our coming travels in their midst.

We are back in Lagos, with a little time to spare before we catch a train to a particularly interesting centre of ground-nut production. We have to " wait

small," as they say in these parts, for the car that is to take us to the station, so let us sit down in deck chairs on the verandah of the friends' house at which we have been staying, and I will tell you a few things which should help you to take a wide view of the industry we are going to watch, and therefore, I hope, add to the enjoyment in store.

The name Ground Nut is very descriptive, for the nuts so called actually mature under the ground.

Ground nuts—I will not apologize for using the name so often, as I am purposely doing so, wanting you to become familiar with it—contain a large proportion of very nutritious oil, about 48 per cent. on an average, which is used in enormous quantities for the manufacture of salad oil, margarine, and kindred foodstuffs, and also of soap and candles. The residual cake after expression of the oil is excellent cattle-food.

You are thinking that these nuts have many points in common with oil-palm nuts. Yes, they are both tropical products, both harbour a generous supply of oil that is good to eat, both are available in commercial abundance, thanks largely to native enterprise, and both go to Europe for the oil to be released by modern methods—with the one little modification that whereas palm nuts are always cracked for export, ground nuts are sometimes cracked, or "decorticated," to use the technical term, and sometimes journey overseas in their shell. But although these two crops have similarities that invite comparison, they are of entirely different origin, absolutely unrelated in the botanical-family sense of the word.

Palm nuts, as you know, are the stone portion of

the fruit yielded by tall forest trees which grow wild. Ground nuts are the " seeds in a pod " of a dwarfish leguminous plant. Argumentative people like to dispute on the one side that they are a fruit; on the other, a vegetable. Take whichever side you like, and the fact remains that they grow in a pod like peas, that they are sometimes called " earth-peas," and that the pod when dry is their well-known straw-coloured or greyish container which is commonly known as the shell.

The ground nut plant is an annual—which is to say, the seeds have to be sown yearly. When we are amongst fields of it under cultivation we shall see how it flowers, and how the flowers give place to pods which burrow into the ground to ripen.

The principal countries from which ground nuts are exported are India (British); the Gambia and Northern Nigeria (British West Africa); Senegal (French West Africa); Mozambique (Portuguese East Africa); China and the Dutch East Indies. The plant is grown in many other tropical countries, and is receiving more and more attention because its value as a fertilizer is becoming more widely recognized and appreciated. Like other leguminous plants, it has the power of taking in supplies of nitrogen from the air and adding this valuable asset to the ground on which it is cultivated. It is very useful, therefore, in a rotation system of tropical crops, having a dual economic value, directly in its yield of nuts, and indirectly as a means of enriching the soil.

The original homeland of the plant is not definitely known. It is not considered to be indigenous to Africa, but is generally believed to have been introduced there

from Brazil, some four hundred years ago, by Portuguese slave-dealers.

The principal countries which import ground nuts are Great Britain, France, and Holland. Before the war, the total annual supply to European mills was over half a million tons; trade in ground nuts, as in other important oil-seeds, has been adversely affected by the closing down of German mills, but, as against this reduction in demand, Great Britain has become a much bigger customer.

Our time together being limited, I have been obliged to select one centre in which to introduce you to the cultivation, harvesting, and marketing of ground nuts on the spot. After careful consideration of the claims and attractions of India, Senegal, and the Gambia as the oldest and biggest producers of commercial crops, my choice has fallen on the British territory of Northern Nigeria, one of the newest ground-nut competitors. The rapidity with which the industry has been developed there is particularly interesting and instructive, and few people, except those who know the country at first hand, are aware of this new competitor's achievements and possibilities.

By good fortune for us as pleasure seekers in the wide realm of industrial activities, it happens that the hub of ground-nut development in Nigeria is Kano, a caravan centre on one of the oldest trade routes of Central Africa. It is a city such as we have never before seen in the whole course of our travels, a city of strange appearance and wondrous charm; a fascinating combination of Old Testament living pictures and the whirligig of modern commercial life; a gorgeous pageant of camels, Arab steeds, and historic tribesmen

straying, as by magic, into an arena of European civilization, whose stage is occupied by stores, warehouses, white men, motor cars, and stupendous piles of ground nuts.

## CHAPTER IX

### WE GO TO KANO

We are nearing the end of a 705 miles train journey from Lagos to Kano. It has been a wonderful experience, this trip through the heart of Nigeria, and we are very grateful to the Nigerian Government Railway for enabling us to penetrate so easily into Central Africa, although for the rest of our life we are not likely to forget the cracked lavatory basin which left us with nothing but a biscuit tin as improvised wash-bowl for three days and two nights; even though we are somewhat tired and distinctly grubby, we can see nothing but the funny side of this one mishap adventure en route. Far from bearing the railway authorities a grudge, we remember that the basin only leaked slightly when we left Lagos, and think with gratitude of the kind official, a fellow-countryman, at an intermediate station, who held up the train and sent post-haste for a native plumber directly we told him about the little defect. Whilst the plumber was busy, we were joyously careering on a trolley with our new-found friend over a fine bridge that spans the River Niger. In the excitement nobody thought to see what the plumber was doing, and it was only after the train was well under way again that we discovered

KANO CITY, NORTHERN NIGERIA.

he had smashed the fitted basin into a crazy patchwork riddled with gaping fissures.

Throughout the journey we have never for one second regretted choosing to travel by ordinary train rather than wait in Lagos for the fortnightly Boat Express, with its superior accommodation. It would have been no treat to us to be transported in corridor carriages, transformable by night into *wagons-lits*, and to be able to adjourn to a restaurant car for our meals. But we have thoroughly enjoyed the novelty of journeying caravan fashion with our own "camping-in" kit and tuckbox—or "chop-box," as it is called in this part of the world—and with a black boy as our cook-general. And, the train not being in a hurry, we have been able to make a good general acquaintance with the country served by the railway.

We have widened our horizon as regards the extent of the West African oil palm forests by passing through one of the great Nigerian belts of oil-palms, stretching from the coast for about 200 miles inland. We have seen the palm forests merging into mixed forests, and these giving place to woodlands and moorlands containing clearing after clearing planted up with cotton, another oil-giving crop. We have skirted the dry open forests of Northern Nigeria wherein, some 600 miles from the coast, flourishes the Shea butter tree; and we have passed beyond their railside reach into broad pasture-lands in the midst of which we are now looking upon the strange sight of numerous herds of cattle.

Thus we are nearing Kano, with many a joyous memory of ever-changing details in the panorama of oil forests, cotton fields, mixed forests and pasture lands en route, with many a vivid mind-picture of countless

little villages whose stockade-enclosed huts are square-shaped way down south and round up north, of a few big open towns, followed by the first appearance of a great walled city, and of a succession of native races typified by the variation of countenance, physique, and costume as revealed by the crowds at the different railway stations. And all our treasured pictures are a rich harmony of clashing colours brought into rainbow-hued unison by the dazzling sunshine, or a beauteous melody of starlit tints bursting into distinct tones of blues, reds, yellows, and purest white in the glow of flaming fires licking the wilds clear for the planting of crops.

In the few minutes we have to spare before arriving at our destination, I want to explain to you why you will often hear Kano called Hausa Town.

Within a large area of West-Central Africa, there are more Hausas than people of any other race. The Hausas are black, but not negroid in type. Nothing definite is known of their origin, but it is generally supposed that they came from the East, entering Africa from the north by way of the Western Sudan. Written records, preserved in Kano, give a list of their Kings which carries their history as an African power back to a thousand years ago. They made themselves masters of a vast territory, which they divided up into seven States. The country over which they ruled included a large part of the Northern Provinces of Nigeria, now British, and adjacent portions of present-day French West Africa extending to the hinterland of the Gold Coast. This great expanse of country is still commonly spoken of as Hausaland or the Hausa tates, for although the people after whom it is thus

called have lost all political power, they have continued to be the most populous inhabitants of their old dynastic realms. Further, they have retained a distinct racial individuality, with striking characteristics, among African natives, of a superior civilization. For similar reasons, the old walled city of Kano, once a mighty stronghold of Hausa power, is still often called Hausa Town.

The Hausas are for the most part Mohammedans by religion. They are skilled craftsmen, good agriculturists, brave soldiers, and particularly keen, clever, and enterprising traders. There are Hausa settlements in many African towns far removed from Hausaland, thickly populated with industrious artisans who carry on such racial handicrafts as weaving, dyeing, embroidering, leather work, and grass mat plaiting. Hausa pedlars travel hundreds, often thousands, of miles, with their pack of native wares, which they replenish at these settlements. The Hausa language is the only language of tropical Africa for which the natives themselves have evolved a system of writing, and it is said to be the most commonly used of all the native languages in Africa.

At the beginning of the nineteenth century the Hausas were conquered by the Fulani, another remarkable people of whom there are large numbers in and around Kano. Their origin, too, is obscure. They consist of two very distinct classes, a select aristocratic or ruling caste, and a peasant populace called "Cow Fulani" because they are devoted to pastoral pursuits. It is known that "Cow Fulani" entered Hausaland from the west as early as the thirteenth century. Naturally the rulers of a pastoral

people strove to get possession of the Hausa States, for the coveted territory embraces wide stretches of pasture-lands suitable for cattle rearing, being free from that dread African cattle-scourge, the tse-tse fly.

Like the Hausas, the Fulani are Mohammedans by religion. In establishing their power they adopted the Hausa system of law and taxation, and when they in their turn were conquered by the British, only as recently as the early days of this century, that system was purified from abuses which had been introduced by degenerate rulers, and restored with certain civilized modifications. Under British guidance, Fulani Emirs still rule in Northern Nigeria.

The Emir of Kano lives in the old city of that name, whose gates are still closed at sundown to all strangers. Within the walls of that city are mud mansions and mud huts, labyrinths of streets and market-places, handicraft centres and village compounds, as in the olden days. Hausas still form the bulk of the teeming population. Except that the walls are crumbling and the dungeons empty, Kano looks the same, and is at heart very much the same, as when the Hausas were the ruling power.

Fascinatingly picturesque in appearance, the old city comes into view. A few minutes later we are looking for our host, who is hunting for us on the densely thronged railway station of the modern town.

## CHAPTER X

### GROUND NUTS IN KANO

KANO, consisting of a newly built European town, a Syrian quarter, an Arab quarter, and the old city, is scattered over a vast sandy plain. Its site, in the heart of Africa, is some thirty odd miles only from the southern boundary of the Sahara.

Hotels are conspicuous by their absence throughout British West Africa, so it is not surprising that far-away Kano cannot yet boast one. We are staying with very kind friends, who were complete strangers to us a few hours ago, and we have just had time to begin to find our bearings.

A short, sandy road from the railway station leads to the sandy main thoroughfare of the modern town. On one side of the thoroughfare a sandy turning or two lead to stores which have been crowded out of the highway; on the other, several sandy compounds provide passage-way between stores in a row, and all lead past big warehouses in sandy yards to the sandy expanse known as the Ground Nut Market.

In one morning we have seen often enough never to forget that the principal commodities which come into Kano for export are ground nuts and skins, and that the principal goods which arrive from overseas for sale to the natives are cotton materials, mostly from Manchester. The great bales of cotton stuffs have travelled by steamer and railway, and we are quite familiar with the European look of these well-wrapped packages, held within the protecting grip of strong iron hoops. But the arrival of the ground nuts and

skins by camel caravans leaves us wondering whether we are dreaming, after we have rubbed our eyes many times to make sure we are awake. Camels in Kano are as common as motor-buses in London. They complete a journey that has taken several hours, several days, even several weeks, by halting outside a Kano store for unloading, as unconcernedly as a motor-bus pulls up at a regulation stopping place in Piccadilly or Park Lane.

The ground nuts come from everywhere within a thirty to forty miles' radius round Kano. We are going into the country for a motor ride to see them being grown and prepared for market.

The car keeps to the broad, sandy main road for a few minutes, then turns off into a narrow, sandy lane, bordered by fields. The landscape suggests for a moment that we are in a country lane on the east coast of England, but a little familiarity with our surroundings rapidly banishes that first impression.

We soon feel that by being in a car we are trespassing on this road, which seems to be a donkey parade. We meet procession after procession of donkeys, carrying ground nuts to market, pass procession after procession of donkeys going home after taking ground nuts to market.

The native name for a donkey is *jaki*. So now you know why the black lads who drive the donkeys to and from market are called jaki boys, and you have doubtless noticed that their favourite costume is a tattered shirt and half a pair of shorts.

A jaki carries a load of about 120 pounds. When this load consists of ground nuts, it is made up into one package commonly called a *tekki*. Tekki is really

the name for the covering of the package, a long strip of hide with cords; filled with ground nuts and fastened up for slinging over the jaki's back, a tekki is an oblong parcel about three feet long and one foot wide, which looks rather like a well-filled hold-all.

Hump-backed, native-bred cattle are also used as pack animals for local goods traffic; a full load for a bullock is about 240 pounds or two tekkis of ground nuts. A camel's load is 450 to 500 pounds, no matter for how short or how long a journey. A camel—native name *racumi*—carries four tekkis of ground nuts.

Although we have been obliged to come very slowly along this narrow, caravan-crowded lane, we are already pulling up at a farmhouse village. A dozen or so little round houses, with mud walls and a thatched roof, are enclosed within a plaited-grass matting stockade. The stockade affords privacy to the inhabitants, and may give them a feeling of security; but in its rôle of a wind-break it certainly does not prevent a generous supply of sand from getting into the family supper when the Harmattan is blowing.

In adjoining sandy fields the villagers cultivate their own staple food crops of Gero (bulrush millet), sweet potatoes, Guinea corn, and cassava, and their contribution to the great export crop of ground nuts, whose Hausa name is "Geda."

Most of the ground-nut growers in the Kano district are Hausas. A few Fulani cultivate the soil, but the majority of the peasant or Cow Fulani are cattle farmers.

The ground nuts grown in the light, sandy soil around Kano are of very fine quality. The crop occupies the ground for four to five months. Pre-

parations for sowing begin after the first tornado heralds the approach of the rainy season, usually in April. With primitive agricultural implements, hand-drawn furrows are made in the fields. The seed is sown by men, women and children following on to cover it up with soil. In six weeks the crop should be making a good show; but the planting is so shallow that the seedlings are often washed and blown out of the ground by a combined tornado and deluge, and a fresh sowing has to be made. Sowing is continued until the end of June, or later, according to the modifications in date and intensity of the rainy season. Harvesting begins about the end of September, and lasts until December or January, November usually being the busiest month.

We are visiting the fields in the late harvest season. The ground nut plant, as you see, is a dwarf, with spreading branches about a foot to eighteen inches long, which have a number of little oval leaves arranged in double pairs. We have come too late in the year to see the flowers, so I must tell you about them from my memory of another occasion, when I saw the fields in bloom. They are borne on a short stem, and resemble the flower of broom in size, shape, and golden colour. Those which spring from the upper leaf axils, towards the top of the branches, are about the size of the flowers on sturdy wild broom; those springing from the lower leaf axils, near the ground, are small and delicate, as if hot-house bred. The bigger, stronger looking flowers are not the ones which yield a harvest; they are not capable of fertilization. The fruitful pods are produced by the small, delicate-looking flowers, whose stems increase in length and turn groundwards,

GROUND NUTS.

(Plant, Flower and "Nuts.")

CAMEL CARAVAN AT KANO.

whilst the blooms give place to tiny white pods, which look like wee baby potatoes. The little pods burrow into the ground, sometimes to a depth of a couple of inches, where they swell and ripen.

Harvesting operations being in full swing around us, you can watch them for yourselves. The branches have begun to wither, thus signalling that the crop is ready to be gathered in. The whole plant is uprooted, carefully pulled up by hand, so that the pods are not detached. We forget for a moment that the pods are attached to the branches and not to the roots, and fancy we have been transported to a fairyland, where magic fields produce crops of miniature new potatoes.

The uprooted plants are stacked in the fields and left to dry. A short walk brings us to a sun-dried stack that is being pulled to pieces by a party of women and children. The pods, still clinging to the branches, have shrivelled, and their creamish tint has intensified to straw-coloured shade. They now have such a familiar look that we exclaim in chorus, "Monkey nuts!" but although the nickname rushes to our lips, this time we voice it with admiration and respect. Some of the women and children are shaking the pods free from the branches, others are shelling them, as you would shell peas. This last operation, as you know, is technically known as decortication; the decorticated produce consists of seeds, commercially called ground nuts. Usually there are two kernels in each pod, but there may be three or only one.

A pestle and mortar are sometimes used for decortication. By this method the nuts, as well as the shells, often get broken, with the result that the oil in them

deteriorates by exposure to the air. Further, the pounded mixture is tossed in a calabash, for the purpose of throwing the shell to the winds, but such a primitive sieving process leaves many bits of shell among the nuts and broken nuts, and thus helps to decrease the market value of the crop.

Some countries export their ground nuts in undecorticated form, just as they are in the shells after drying. The bulk of the Kano crop, however, consists of hand-picked, clean, shelled nuts, which, being of superior quality both by nature and mode of preparation, command a good price.

Some of the Kano farmers sell their ground nuts in advance to a native broker of their own choice or a favoured one chosen by their Chief. Others sell after the harvest to a broker in the open market. The whole of the crop, amounting annually to well upwards of 50,000 tons, is taken to Kano by camel, donkey, or bullock caravan; by far the largest portion is transported direct to the special Ground Nut Market, and thither we are going to see how it is disposed of for transfer to European factories.

## CHAPTER XI

### THE GROUND-NUT MARKET IN KANO

We are in a howling desert. Within the bounds of something that is happening on a vast sandy plain, we find ourselves in a dense pack of black and tawny natives, camels, donkeys, bullocks, and horsemen, surging between flag-signalled booths to the deafening

roar of a Babel of shouting and a jazz chorus of noisy beasts. Have we struck some strange fair or the encampment of a travelling menagerie? Neither the one nor the other; we are in the Kano Ground Nut Market, within a stone's throw of the European stores that flank the highway of the modern town.

The market-place, about a mile long and in some places as much as half a mile wide, is a great irregular-shaped pitch on a vast plain of sand that sweeps away to a far horizon. It is intersected by wide roads, which enter it from the level plain, over which they come in dead straight lines from the neighbouring country. Located on the pitch, in close proximity to each other, there are about two hundred ground-nut-buying plots, each occupied by a booth, a broker and his assistants, some type of scales and various measuring appliances.

The booths, called Rumpahs, are oblong, open-fronted tents, supported by poles, roofed over and enclosed on three sides with grass mats. Each rumpah flies one or more flags announcing the number of the plot, and displays a name sign, together with other ingeniously attractive information of the "old firm" variety.

The broker occupant of every rumpah is a born trader, skilled in the showman's arts, wiles, and jargon, which he has adapted to his particular business of buying ground nuts. Most of the brokers are natives, the two principal trading races of Nigeria, the Hausas of the north and the Yorubas of the south being prominently represented; the motley collection of rival buyers also includes several Syrians and some Arabs.

Each broker stands at or near the entrance to his

rumpah, with his native clerk at his side and a gang of boys in close attendance.

We have edged our way to a vantage spot alongside one of the rumpahs, before which a caravan of camels has been halted at the word of a scout, who has brought along a client. The scout introduces to his boss the farmer whom he has bribed to follow him hither. There is a lengthy palaver between the broker and the farmer on the subject of price, but at last a bargain is struck. At the word of command from the drivers, the camels kneel down to be unloaded. Tekkis are uncorded, contents are measured out in buckets, each bucketful going to swell a mound of ground nuts that is fast spreading itself over the area of a big tarpaulin sheet and growing to a giant height. Meanwhile the broker's clerk keeps count of the number of bucketfuls delivered. When the last camel-load has been added to the tally, the farmer is paid and the caravan moves off to camping quarters in the market-place, where a picnic meal is indulged in prior to wending the way home to fetch the next load of ground nuts.

As we become more accustomed to our surroundings, we sharpen up to spotting opportunities for diving through the crowd, and make our way from rumpah to rumpah, adding picture upon picture to our memories of this unique trading centre. Horseman after horseman comes dashing on the scene, mounted on a gaily caparisoned Arab racing-steed, which he rides with the grace of a born cavalryman and the skill of a star jockey. Every horseman has come to sell ground nuts, or, in his rôle of Chief, to see that the farmers under him are selling to a certain broker as

pre-arranged. In the galaxy of native costumes, outstandingly picturesque is the Hausa gown, a long, wide cotton garment, finely hand-embroidered and native-dyed in some shade of indigo blue, which is slipped over the head and hangs in picturesque folds over wide-bodied trousers that fit tight to the ankle. Strange amongst many strange sights is the forbidding appearance of the camel men, which gives us a creepy feeling; we are not surprised to hear that these men, with the robber-like custom of completely veiling their faces except for the eyes, belong to one of the most fearsome races of Darkest Africa—they are Tuaregs from the lone regions way back in the Sahara to the north of Kano. They are descendants of the most dreaded bandits that infested the old trade route from Kano to the Mediterranean, and sufficiently unconquered and untamed to be feared by the caravans that still occasionally follow the old route to the sea.

Before leaving the ground-nut market, we take a last sweeping look across the plain. An endless procession of pack-laden animals is still wending its way along every road in sight, thrusting its head into the market-place and continuously picking up a new tail from the borderland of the far horizon. Thus, from sundown to sunset, every day for several months in the year, ground nuts come pouring into Kano.

The caravans which arrive in the afternoon camp in the market-place till the following morning, the brokers being too occupied with another part of their business to bargain with the farmers after lunch-time.

The kind friends with whom we are staying have evidently plotted to give us a memorable ground-nut day. When we arrive back for lunch, we are greeted

with a dish of roasted ground nuts as *hors d'œuvre*—they are as tasty as salted almonds, and we make a mental note to introduce them into our menu when we get home. Later on comes a ground-nut stew, a most delicious course of chicken and pounded ground nuts *en casserole*.

Our host is an English trader, representing a big British Company, for whom he sells Manchester goods in the canteen below his residential quarters, and buys ground nuts, sometimes direct from the farmers, but usually from the brokers in the market-place. Like others of his fraternity in Kano, he has no time to rest after the midday meal. As we, too, are keen to make the most of our opportunities, we hastily dispose of a cup of coffee, put on our sun helmets, and follow him into the compound of his produce store.

Some rival brokers are beginning to deliver several tons of ground nuts they sold to our host some days ago, and, having just caught up to his order on their list, started to buy this morning.

The ground nuts, now in sacks, are being headed into the compound by strings of carriers, and each batch of carriers is attended by a broker employer.

Numbers of boys outside the produce store await the arrival of their white master. Under instructions from our host, one of his assistants unlocks the big doors of the store, and we pass into the weighing room. The brokers, now just outside the doors, are excitedly engaged in a palaver as to whose bags shall be weighed in first. Our host lets them scream at each other for a few minutes, whilst his clerk gets out the books and his boys take up their places, then he summarily stops

the argument by calling out the name of the broker who is to be the first to receive attention.

The bags are weighed twelve at a time on large platform scales. Each bag should contain $1\frac{2}{3}$ cwt., and if, as is usually the case, each load weighs 20 cwt., the first stage of checking in is finished by the receiving clerk calling out the entry he is making. To a din of chatter, jokes, and snatches of song, the broker's carriers then hoist the bags on to the heads of the produce buyer's boys, who run off with them into the adjoining store.

This store, or warehouse, is a great barn, whose walls are strengthened by a solid lining of full bags of ground nuts, carefully stacked. The ground nuts are bulked into the capacious hold within the stacked bags. As each boy arrives, he clambers on to a mountain range of loose ground nuts and shoots out the contents of his bag under the eagle eyes of a white inspector and his native assistant. A sharp look-out is kept for dust, broken shell, and make-weight foreign matter, such as old lumps of sun-baked mud; also for delivery of all bags checked in, for the broker's boys think it great fun to throw checked-in bags back into the compound just outside the weighing room, and doubtless get rewarded if they play the trick successfully.

As each broker finishes the day's delivery, the clerk hands him a ticket on which is noted the total weight checked in, and this is honoured by the produce buyer in his office at a pre-arranged price rate.

When all his stores are full, and the goods trains are all booked up until a dim and distant date, the produce buyer makes room for more ground nuts by setting his boys to work at bagging stored supplies and stacking

the bags in the compound. Pyramids of bagged ground nuts awaiting their turn for room on the train to Lagos, en route for Europe, are a feature of modern Kano.

## CHAPTER XII

### THE WALLED CITY OF KANO

We should be very small-minded commercial travellers if we left Kano without visiting the old walled city. For although it has little to show us that will add to our practical knowledge regarding the production and use of vegetable oils, it is imbued with much power to help us understand and appreciate native life in relation to vegetable oil development.

Ancestral birthright is the recognised right to residence within the old city's walls. The Hausa inhabitants have inherited their claim to citizenship from fathers and forefathers back to time immemorial. The Fulani inhabitants spring from ancestors who established themselves within the walls by right of conquest, but that was more than a century ago, and sufficient time has elapsed for conquest rights to be merged in the birthright qualification. There are Arabs and members of other native races living within the walls, but they, too, have an old-established right to residence, derived from privileges granted to their ancestors, or from other special circumstances.

It is about a quarter of an hour's motor run from modern Kano to the old city. The latter part of the road is bordered by pasture-lands and fields of guinea-corn, which prepare us to find that the founders of

GROUND-NUT MARKET AT KANO.

Kano were wise enough in their long-ago generation to choose a fertile site on which to establish their stronghold.

Suddenly there looms up before us the forbidding face of a high wall. We are on the threshold of one of the oldest known mid-African centres of trading relations with the outside world.

The great wall which surrounds the city has a total length of nine and a quarter miles, and is fifty feet thick at the base. It originally rose to a height of about thirty feet, and was capped with bastions, behind which was a platform for the defending forces; in case of attack, the warriors were dependent on bows and arrows and stones in the early days, but later on they had plentiful supplies of guns and ammunition, obtained by a brisk barter-trade with the Europeans on the coast. The battlements have disappeared, but otherwise the walls are still in good condition; as, however, it is now forbidden to repair them, they are apparently doomed to crumble away, leaving the world historically, artistically, and architecturally the poorer for their loss, as they are built of mud. The mud is in the form of roughly made bricks, conical in shape, six to eight inches high, and about the size of a small tea-plate at the base. The colouring of the bricks is a rich orange-red, due to a natural dye imparted by a vegetable binding material that plays the part of straw, with a wondrous range of shade gradations added by the magic touch of those two great decorative artists, time and the play of sunshine.

Thirteen gateways give access to the city. We drive through the fifty-feet long passage of one of them and find ourselves in the midst of what seems to be, at

first sight, a huge-scale model of a county including several towns and villages. The total area of Kano City is seven and a quarter square miles. The low-built mud houses permit of a wide-sweeping view, revealing groups of habitations, streets, squares, and glimpses of country-side which conjure up the first curious impression that we are looking upon a well-made geographical model.

We stop to enjoy the artistic treat provided by the fine geometric designs adorning the inner entrance of the gateway and the adjoining portions of the great wall. Passers-by greet us in Oriental fashion by prostrating themselves on the ground.

Our car next pulls up at some little distance within the walls, at the side of a large open space. A *dogari* member of the old-established police force of the city crosses over to us, salaams, and enters into conversation with our host, through the medium of an interpreter we have brought with us. He is joined by other members of his picturesque fraternity, in their uniform of blue draperies and thickly folded red turbans. One *dogari* takes charge of our car; three others accompany us as guides and guard of honour, in which latter rôle they are kept busy flicking a passage for us through the crowd with short-handled swishes.

We go first to the cotton market, for we have timed our visit for a Sunday afternoon, which is the busiest time of the week there. Rolls of cotton materials are piled up all over a large open ground-space and alongside the adjoining streets, and standing amidst the dense crowd of customers are countless Hausamen with packs of cotton stuffs on their shoulders. Prominent amongst the wares is the native hand-spun and hand-woven material known as Kano cloth, which

has been famous for centuries all over the Sudan; like all Europeans who have the good fortune to come hither, we eagerly purchase lengths of the finer qualities, in creamy white for summer costumes, in indigo-striped patterns for loose upholstery coverings. Conspicuous, too, are rolls of white cotton materials, which have been bought wholesale by Hausa traders from the European stores in modern Kano, and are now being sold semi-wholesale and retail to fellow-inhabitants of the old city; blue is the popular colour with most of the natives in this part of the world, and white materials are preferred because they can be native-dyed to any shade of blue in the indigo pits.

We are taken to see the dye pits, a numerous collection of holes in the ground, occupying a special site near one of the principal gates of the city. Hundreds of men, women, and children are steeping balls of indigo mixed with the ashes of a vegetable product which sets the dye, dipping lengths of cloth and ready-to-wear Hausa gowns, and skilfully preparing material or gowns to come out of the pits decorated with some attractive pattern in white. Patterns are obtained by a method which is akin to the principle of smocking. Portions of the material or garment which are required not to take the dye are gathered up into little bunches or pleats, and tied round or stitched over with yarn or grass; after dipping, the threads are untied and unpicked, and the light or dark blue groundwork displays some pretty geometric pattern in white.

We are conducted through a maze of narrow streets flanked by mud houses which open direct on to the sandy traffic-way, and despite the cheers of our attentive escort, of courteous pedestrians and gracious

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loiterers at hut doors, our passage is often disputed by herds of cattle and goats. We come out into the food market, pass on to the basket and matting market, go down the street of the blacksmiths, and zig-zag across to a fancy-fair market, where we bargain for beads and other native-made knick-knacks, tender silver in payment for our souvenirs, and receive our change in cowrie shells. This long walk, interrupted by many delays, brings us eventually to the leather market, with its neighbouring huts where highly skilled workers are making and embroidering saddlery, bags, sword scabbards, cushions, and other bright-coloured red, green, and yellow leather goods. Kano leather work, like Kano cloth, has found a ready market throughout the Sudan for centuries; it is now beginning to be very fashionable in England. Kano leather, which is to say, tanned and dyed goat and sheep skins, has been coming to Europe since once-upon-a-time days. We all know and appreciate it under its European name, "Morocco leather." From very early days there was a brisk caravan trade in this leather, the skins being transported on camels from Kano to the ports of Northern Africa, whence they were exported to European ports on the Mediterranean. A big trade in Kano leather is still carried on, but most of the skins now travel by rail to Lagos, en route to Europe.

We have the honour of being invited to enter the mud house of a wealthy trader in the Arab quarter. We squat on the floor of his living-room-store, and in a delicately perfumed atmosphere smile our appreciation of his hospitality. It is good to have a rest in a quiet and comparatively cool room; the thermometer stood at 118 degrees in the shade at midday, and we have been

spending a long afternoon in the glare of the blazing sun and the thick of dense crowds. The population of Kano city is estimated at upwards of 1,000,000, some people say nearly 2,000,000. We can well believe that the higher figure is the more correct, and that the whole population had congregated in many of the markets we have been to this afternoon.

Leaving the Arab quarter, we wend our way to the mud palace of the Fulani Emir, who rules over the city and a wide area of the surrounding country, which are together known as the Kano Emirate. The system of government, as I have told you, is that of the old Hausa kings, modified by British control since Kano citadel was stormed and taken by British troops in 1902.

Near the palace we meet by chance some of the Hausa brokers whose acquaintance we made in the Ground-Nut Market of the modern town. We also run across a merchant who is known to our host, and who takes us to see his large ground-nut store in the old city. The near approach of sunset cuts short this last visit. We have to hurry back to where our car is waiting, for all strangers must leave the city before darkness signals the moment for closing the gates. We are only just in time to respect the law, and as we drive through the nearest gate we see a vendor of sugar-cane lighting her lamp—a gourd with a floating wick in ground-nut oil.

The ground-nut industry of Kano has only been developed commercially during the last few years, since British administration put an end to tribal warfare, with its devastating work of village-raiding and laying waste the countryside, and its intimidating influence

of driving villagers to forsake their fields and take up their abode under the protection of city walls.

During the boom in the spring of 1920, the market price of ground nuts in Kano went up to £41 per ton. Their pre-war price and the importance of the crop have been recorded in a ditty known as the Kano National Anthem; it is sung to the tune of Holy, Holy, Holy, and is chorused to us as a parting blessing by the jolly good fellows who have gathered on the platform of Kano station to bid us farewell:

Ground nuts, ground nuts, ground nuts,
Ground nuts all the morning,
Ground nuts all the afternoon and
Ground nuts all the night;
Ground nuts, ground nuts, ground nuts,
Nothing but bloomin' ground nuts,
Four—thirteen—four and
No com-mis-si-on.

## CHAPTER XIII

### WE VISIT A COCONUT PLANTATION

THERE are two main sources of vegetable oils—namely, forest products and cultivated products, the latter comprising field crops and plantation crops. We have made the acquaintance of the oil-palm, the principal forest contributor to commercial supplies, and of ground nuts, one of the leading field-crop contributors. We are now going to see something of the important part taken in the vegetable oil industry by coconuts, a plantation crop.

Coconut oil is contained in the white, fleshy portion of the nut. The dried kernel, known as "copra," is exported in vast quantities for oil extraction. Thous-

ands of tons of this oil are now used annually for making margarine, bakery fats, soap, candles, night lights and cosmetics.

Coconut cultivation is one of the oldest agricultural industries in the Tropics, for the tree—which, as you will remember, is botanically related to the oil-palm—has long been valued by many native races as their mainstay source of food, drink, building materials and other necessities and luxuries. Native ways of extracting oil from the nuts and utilizing supplies pointed the way to commercial developments; throughout the tropical regions of the Far East, for instance, coconut oil expressed in primitive mills has long been in general use for culinary purposes and for toilet accessories, such as hair oil and beauty make-up; and until the comparatively recent introduction of mineral oil, the Eastern native relied largely on coconut oil as an illuminant.

The growing demand for vegetable oils for modern manufacturing purposes attracted the attention of white planters to coconut growing, and led to the opening up of large estates under European management. Gradually, the example of up-to-date methods of cultivating the crop and preparing it for the oil-seed market induced many native farmers to make a more or less careful study of this branch of agriculture, and to increase their acreage under coconuts. Prominent among the countries in which large coconut estates have been established are Ceylon, British Malaya, Southern India, Fiji, the Solomon Islands, the Netherland East Indies and the Philippines. British planters have played a leading part in the development of the coconut-planting industry.

The coconut palm, *Cocos nucifera*, most commonly cultivated, grows to a height of about eighty feet. The trunk is unbranched, scarred by the marks of fallen leaves, and surmounted by a crown of leaves, some eighteen feet long. Male and female flowers are borne on the same stalk; when young, they are cradled in the spathe or leaf wrapper, which unfolds as the flowers open. The average age at which the trees begin to yield a harvest is six years, and they are doing well at that age if they give ten ripe nuts. The yield increases annually until the trees reach maturity, at the age of about thirty years, when the average harvest is about eighty ripe nuts. In exceptional cases a full-grown tree may bear as many as 300 nuts, half of which may mature. The trees may go on yielding until they are seventy to eighty years old, provided their life is not cut short by drought or any other weakening influence.

Another variety of coconut palm favoured by planters is a dwarf, popularly known as the "King" coconut. The nut is smaller than that yielded by the *Cocos nucifera*, but the tree requires less growing space and begins to bear fruit when it is about four years old.

We have come to British Malaya to visit one of the many coconut estates in the East which have been developed by British enterprise. It belongs to a Company, for whom it is managed by a Scotsman. By profession, the manager is a gentleman farmer, or "planter" as they say in the Tropics; under him are several white assistants of the public-schoolboy class, and a native labour force.

We are on an estate which is intersected by such good, wide roads that we can do most of our sight-seeing in a motor-car. When we get down to strike

PYRAMIDS OF GROUND NUTS AT KANO.

off for centres of operations that lie back from the main arteries, well-kept paths make walking easy. All around us are full-grown coconut palms, standing at even distances apart in straight lines. Everyone we see at work obviously knows his job. In short, everything is in such perfectly going order on the estate that it is impossible for us to appreciate our surroundings without understanding how they came into existence.

Please shut your eyes a minute and imagine you are in the midst of tropical jungle, standing in dense undergrowth and hemmed in by trees whose intertwining branches mingle with matted creepers to form a roof that hides the sky. From such a wilderness sprang the estate we are visiting.

In transforming jungle land into a coconut plantation, the first thing to be done is to make a clearing. Trees are felled, undergrowth cut, and a light set to the great tangle of unwanted vegetation. After the bonfire has done its work, stumps of trees must be uprooted, and all débris removed. As a preliminary to further operations, a permanent labour force must be recruited; some native Malays may be available, but sooner or later it will be necessary to recruit Tamils from India or Chinese coolies.

Now comes the work of road-making and path-making, and, if the land is low lying, digging drainage trenches.

Next, the areas which are to be planted up are lined, stakes being put in at even distances apart to mark the position each coconut palm is to occupy. At each stake-marked spot a pit is dug to receive a seedling.

Meanwhile, specially selected seed nuts are being reared in the nursery part of the clearing. At the age

of six or seven months strong seedlings, fit and ready to be transplanted, have leaves of about a foot high.

When the seedlings have been removed to their permanent quarters, the planted areas must be fenced in to keep out wild animals, and the young palms must be kept well weeded.

There is a good deal of building to be done, too, in connection with estate-making—country-house bungalows for the manager and his white staff, coolie lines for the labourers, and, as the time approaches for gathering the first harvest of nuts, outhouses for the preparation of copra.

Ripe nuts often fall to the ground; fortunately, they usually choose to do this during the night, when no one is about. Natives climb the trees to pick the remainder of the harvest; they go aloft by means of an improvised ladder of notches cut in the trunk, and upon reaching the base of the crown they hold on by one hand and pick with the other.

A coconut as it comes from the tree is ovoid in shape, smooth skinned, and rather bigger than a football. The nut as we know it is enclosed in a husk, a fibrous covering from two to three inches thick.

Continuing our round of the estate we are visiting, we come to a large outhouse, where coolies are busily at work husking coconuts. Each nut is given a smart bang on a crowbar which is firmly fixed in the ground, pointed end up; the husk is thus broken through, and the fibrous covering is now torn off by hand, revealing a familiar-looking coconut in its shell. The husked nut is next split in two with a hatchet, and the milk drained away.

We pass on to the drying house, consisting of a

raised wooden platform, with a sliding roof. Halved coconuts are spread out on this platform, hollow side up, drying in the sun; the roof will be rolled back over the platform at night, or at any time of the day when rain threatens to interrupt the drying process.

When after a few hours the half-kernels have shrunk from the shell, the pieces of the latter are removed, and the kernels are further exposed to the sun for several days, during which time they are frequently turned, and finally become the export product commercially known as copra.

There are several ways of husking coconuts, as, for instance, by a blow with a cutlass, or the use of specially designed labour-saving machinery. The kernel, too, is sometimes dried by means of smoke or hot air.

The market value of copra is influenced by such details as methods of cultivation and preparation. But all marketable supplies have a value over and above that of the oil contents; the residue after oil extraction, known in the East as "poonac," commands a price, and in the case of good qualities a very high price, as cattle food and as a fertilizer.

Large quantities of coconut oil for export are also produced annually on the spot in some coconut-growing countries, notably in India, Ceylon, British Malaya, the Philippines and the Netherland East Indies. Primitive native methods of expressing the oil, such as a roundabout mill of grindstones worked by oxen, are commonly employed, but several modern oil mills have been erected. Ceylon, which is well equipped with such mills, is the biggest British exporter both of copra and coconut oil. Most of the modern mills, however, for the treatment of copra on a large scale are located

in Europe; there are several, too, in the United States of America and some in Australia.

In Ceylon alone there are about 1,000,000 acres under coconuts; in India, nearly 500,000 acres; and in the Federated Malay States, a portion only of British Malaya, about 180,000 acres. Exports have been seriously handicapped by war and post-war conditions; but the following figures give a rough indication of the part played by coconut oil in manufacturing activities: In 1921, Ceylon alone exported over 1,000,000 cwt. of copra, of which the United Kingdom took about 66,000 cwt. In the same year the United Kingdom imported, from all sources, over 40,000 tons of unrefined coconut oil.

## CHAPTER XIV

### OTHER SOURCES OF SUPPLY

Among other vegetable-oil sources which are being exploited commercially on a large scale, Cotton Seed is the most important.

The cotton plant of commerce is an annual, which grows in the form of a shrub. It is cultivated within wide areas of many tropical and subtropical lands. The largest cotton belt in the world is in the Southern States of America, where many millions of acres are devoted to the crop. India and Egypt, two of the oldest cotton-producing countries in the world, are very big growers, and in recent years considerable progress has been made in cotton cultivation, both as regards increase of output and improvement in quality, by many other countries, with British possessions and Brazil well to the fore in such developments.

The primary object of cotton-growing is the harvest of lint, which goes to the world's cotton mills for the spinning of yarn and weaving of cloth. But the extraction of oil from cotton seed has become such an important industry that, although it is secondary to lint production in relation to the cotton crop, it is one of the principal branches of the vegetable-oil industry.

Cotton plants bear fruit in the form of pods. When the fruit is ripe the pods burst, and the bushes look as if they had been richly decorated by Father Christmas with balls of cotton-wool. Each pod contains numbers of seeds, and to each seed countless strands of fibre are attached; so closely packed are these strands of fibre that they conceal the seed to which one end of each is joined up. Contents of the pods are picked out by hand and transported to a ginnery, so called after the ginning machines which are specially designed to strip the fibre from the seeds. The stripped fibre or lint is raw cotton, ready to be baled for export. The seeds are further treated by machinery for the removal of down and any fibre still adhering to them. Specially selected myriads are reserved for sowing. The myriads which are destined to part with their valuable oil contents go to crushing mills.

The United States produce the largest amount of cotton seed; of the big supplies available for oil production, only a small proportion is exported, the bulk being expressed in the country. The United Kingdom is a big importer of cotton-seed oil, and also a big producer; under normal trading conditions prior to the war, well over half a million tons of cotton seed were imported into the United Kingdom, chiefly from India, Egypt and Brazil.

Cotton-seed oil is edible. Highly refined grades are used very largely in the manufacture of margarine and salad oils; vast quantities are also employed for soap and candle making. The residual meal, after the oil has been expressed from the seeds, is compressed into cake, which is a very good cattle food.

Among the principal sources of other vegetable oils which have a well-established commercial standing are:

Rape Seed, which is obtained from several varieties of plants belonging to the cabbage family, the most common of which is known as colza, rape, or coleseed. India is an important source of supply. Under the name of "colza," the oil is used as an illuminant. Rape-seed oil is edible, and well refined, best qualities are employed in the manufacture of margarine.

Sesame Seed, derived from an annual plant which is grown throughout the tropics and subtropics. It is known in commerce under various other names, such as benni, sim-sim and gingelly. Sesame oil is used in the preparation of edible oils and fats, also for soap-making.

Soya Beans, the product of a leguminous plant which is cultivated on a large scale in China and Japan. The first noteworthy export of soya beans was made in 1908-9. Soya-bean oil is used in the manufacture of margarine and soap. In 1921, the United Kingdom imported upwards of 60,000 tons of soya beans.

Olives, the fruit of the olive tree. Olive oil, derived from the fruit pulp, is, when unadulterated, the best quality salad oil. It is also suitable for lubrication.

Linseed, the seed of the flax plant. Canada, British India and the Argentine are large exporters of this oil-seed. In 1921, the Argentine alone exported over

1,000,000 tons. Linseed oil is used extensively in the manufacture of paints, varnishes and linoleum.

Aleurites Seed, the product of a tree grown in China, and the source of Tung or Chinese wood oil, which is used in the manufacture of paints, varnishes, lacquer and linoleum.

Castor Seed, furnished by the castor plant. India is the principal country producing castor seed and castor oil. Besides being a valuable medicine, castor oil is a fine quality lubricant, and is used as such for aeroplane parts and other delicate machinery.

Croton Seeds.—The croton oil of commerce is obtained from the seeds of a small tree, or big shrub, which is a native of India. It has powerful medicinal properties akin to those of castor oil, together with a characteristic power of blistering the skin.

Almonds, peach kernels, sunflower seed, mowra seed sometimes called illipe nuts (the product of Bassia trees, which grow wild in India), hemp seed and maize also contribute to the vegetable oil supplies of the commercial world.

Many other varieties of vegetable oils are being used locally by the natives of different countries. Some are already being utilized on a comparatively small scale for manufacturing purposes. But three conditions must be in its favour before a new variety of vegetable oil can court commercial recognition with any chance of success:

1. The suitability of the oil for specific manufacturing purposes must have been proved by experiments.

2. The oil must be capable of extraction at a cost which will permit of competition with other oils of a similar nature.

3. The oil-yielding product must be sufficiently abundant in the wilds, or capable of cultivation on a low enough economic basis, to make the commercial adoption of the oil worth while.

It is believed that there is a great commercial future for an edible vegetable fat known as SHEA BUTTER, which some manufacturers are already using. Shea nuts are the fruit of a forest tree; they resemble horse chestnuts in size and appearance, and grow in a similar way within a fleshy rind. To extract the butter, the natives first peel and dry the nuts, then pound them to a fine flour; the flour is mixed with a little water and re-pounded, after which it is put in hot water to separate the fat. The fat rises to the surface and solidifies as it cools; it is re-melted for clarification, and poured into moulds made from plantain leaves or the sheaths of maize cobs, wherein it sets. Shea butter is exported in these moulds.

Shea trees abound in the open forests of Northern Nigeria, in the Northern Territories of the Gold Coast, and in French West Africa. It is estimated that there are, roughly, 192 million shea trees in the Gold Coast, capable of producing over 250,000 tons of shea butter annually.

## CHAPTER XV

### USES OF VEGETABLE OILS

WHILST seeing how vegetable oils are obtained, we have come to know some of the uses to which they are put in the industrial world. But we shall be better able to understand and appreciate how important a

SPLIT COCONUTS DRYING FOR COPRA, MALAYA.

*By permission of the Malay States Information Agency.*

part they play in manufacturing activities if we enquire into their composition.

All the oils we have seen or talked about on this tour belong to one big class called Fixed Oils and Fats. We have noticed that most of them are contained in seeds or nuts, the principal exceptions being palm oil and olive oil, both of which are embodied in fruit pulp.

Fixed oils and fats are a mixture containing a preponderance of glycerides of fatty acids (glycerol combined with fatty acids), together with small quantities of colouring and other matter, and a certain amount of natural moisture.

Certain variations in the nature of their composition qualify them respectively for special branches of manufacture. Such variations in relation to scope of service have led to different groupings, of which the principal are DRYING OILS, SEMI-DRYING OILS, NON-DRYING OILS, FATS, and EDIBLE OILS AND FATS.

DRYING OILS.—These contain acids which, on exposure to light and air, quickly undergo chemical changes that impart drying properties. Such oils are specially suitable for the manufacture of paints, varnishes, lacquer, linoleum and waterproofing materials. Obviously they are unsuitable for use as lubricants. The most important commercial members of this group are linseed oil and Chinese wood oil. Results of experiments suggest a commercial future for Para rubber seed oil.

SEMI-DRYING OILS.—With members of this group, lengthy exposure to light and air is essential to the development of drying properties. As a rule the drying tendency is too strong to admit of these oils being used as lubricants, but not strong enough to take the sticki-

ness out of the thinnest coat of paint or varnish. Such oils are employed largely in the manufacture of soap and candles; some, also, have medicinal properties, and some are edible. The principal commercial members of the group are cotton-seed oil, rape-seed oil, soya-bean oil, sesame-seed oil and croton oil.

Non-Drying Oils.—These remain liquid on exposure to light and air within a wide range of climatic conditions. Even though they may be induced to solidify by the action of excessive cold, the solidified body has greasy, slippery properties in contrast to the stick-fast adhesive properties of drying oils. Consequently, non-drying oils are specially suitable for use as lubricants. Some are also used as edible oils, some for soap-making and some for medicinal purposes. The most important commercial members of this group are olive oil, ground-nut oil, almond oil, peach-kernel oil and castor oil.

Fats.—The name is rather misleading, for it includes oils which are liquid in their tropical countries of origin, but become solid or semi-solid in temperate climes. The principal commercial members of this group are palm oil, palm-kernel oil and coconut oil, all of which are influenced by temperature in the way indicated. Being very wholesome and nutritious, they enter largely into the manufacture of foodstuffs, and they are also very suitable for making soap and candles; some have particularly good qualities for the preparation of cosmetics.

Shea butter is an entirely true-to-name member of this group, for it is a solid even in tropical climes.

Natural tendency in oils to become fats and *vice versa*, and the necessary temperature to bring about the

change, are details dependent on and regulated by the composition of the oils; for instance, matter known as "stearin" promotes solidification more or less in proportion to the amount of it contained in the oil. The lowest temperature at which an oil will naturally change from a solid into a liquid is called the "melting-point."

The members of this group have a high melting-point, which is to say, they naturally remain solid or semi-solid when exposed to the action of moderate or considerable heat, up to or approaching the limits of an ordinary hot day in temperate countries. This characteristic of their nature renders them specially suitable for certain branches of manufacture, as, for instance, margarine for pastry-making.

Edible Oils and Fats.—This group includes all oils and fats which are good for human consumption, being wholesome and nutritious and free from special medicinal properties. Many members, such as palm oil, palm-kernel oil, ground-nut oil, coconut oil and cotton-seed oil, have a utility scope which also brings them, as we have seen, into other groups, but superior qualities only are used for edible purposes, and they are highly refined for this special service. Edible oils and fats of vegetable origin are used for the manufacture and preparation of numerous foodstuffs, such as margarine, vegetable "butters," kosher margarine for Jewish consumption, bakery fats, salad oil, oil for canning fish and frying oil.

Numerous as are the recognized uses of vegetable oils for manufacturing purposes, there are good reasons for believing that their commercial possibilities are by no means exhausted. It is thought that fuel vegetable

oils from the Tropics may some day prove a revolutionary new source of economical power. Some specially designed motor engines are already being run on such fuel with promising results.

We are now going to see how oils are extracted from seeds and nuts and refined for manufacturing purposes. But before we turn our attention to that branch of the industry, I just want to point out to you that there is another important class of vegetable oils, called essential oils. These are aromatic, and are used extensively for perfumery; being volatile, they are generally recovered by a process of distillation. I hope we may go a-wandering together some day to see the many beautiful forms of plant life which harbour aromatic oils. Suffice for the purpose of our present trip to tell you that sweet-smelling oils are used in the manufacture of scented soap, and that many varieties are obtained from such well-known plants as lavender and geranium.

## CHAPTER XVI

### EXTRACTION AND REFINING

The principal modern processes of extracting oil from seeds and nuts are:

1. Expression by high-power pressure.
2. Extraction by chemical solvents.

After extraction by either process, vegetable oils generally undergo a process of refining preparatory to being utilized for manufacturing purposes; the degree to which they are refined varies according to the use to which they are to be put, rising in the case of those

destined for human consumption to a high standard of purity.

To watch the transformation scenes which link up oil seeds and nuts with oils and fats ready for the manufacturer we have come to the large, up-to-date works known as the Raffineries du Congo Belge, situated in the Belgian village of Baesrode, near Termonde, and about an hour's motor run from Brussels.

In spacious warehouses we renew acquaintance with many varieties of oil-seeds and nuts, such as palm kernels, ground nuts, copra, illipe nuts and shea nuts; some are still in sacks, some have been unbagged and stacked loose in hillock-high piles. All the seeds and nuts we see here are edible varieties, for these works specialize in the extraction and refining of edible oils and fats.

Men are busy shovelling the raw materials into mechanical sifters, which eliminate dust, bits of shell and other foreign matter; this preliminary treatment facilitates the flow and improves the colour of the oil.

The cleaned raw materials are measured out of the warehouses and taken to the grinding house. Following them thither we are greeted by the din of machinery. Seeds and nuts are getting a preliminary pounding in breaking machines, which have somewhat coarsely grooved rollers; small pieces, as delivered by the breaking machines, are being flaked to a fine meal in crushing machines, which have finely grooved or smooth rollers. There are different types of machines, each specially designed to treat different seeds and nuts according to their respective size, degree of hardness and other natural peculiarities. Small seeds are not passed through a breaking machine, but go straight

to a crushing machine. The general principle of crushing, however, is always the same—the result is always a finely-flaked meal; and raw materials are always first reduced to a meal, no matter whether the subsequent treatment for oil extraction is to be by the Expression Process or the Solvent Process.

In continuing our tour of these Works, we are taken to see the subsequent stages of the Expression Process. In the second stage of this process the meal is cooked. It is automatically conducted to steam-jacketed kettles, in which it is heated for a given time at a special temperature. The final stage of the process shows us the expression of oil by hydraulic pressure. The heated meal is automatically fed into capacious press-boxes, drum-like receptacles that have an inner and an outer chamber; the wall of the inner chamber is perforated. A measured charge of meal drops into the drum, and over it are placed a filter-cloth and a heavy steel plate; a second charge of equal measure is fed to the drum and covered in the same way, and so on until the drum is full. Filled drums are put into presses, which are fitted with rams. Varying degrees of pressure on a rising scale are brought to bear on each drum for the duration of rather more than an hour, during which time the oil runs out of the meal and passes through the perforated inner lining of the drum to the outer chamber. The crude oil is discharged from the outer chamber into troughs, whence it is pumped to storage tanks. The residual meal between the plates is now in the form of cakes, which have retained only a comparatively small percentage of oil; being composed of edible, nutritious materials capable of digestion by cattle, this residue

is the valuable commercial by-product known as cattle cake. Details of treatment in the final stages of the EXPRESSION PROCESS may vary, but the general principle remains the same; for instance, the cooking stage is omitted in the treatment of some seeds, the quality of the oil yielded being superior when they are cold-pressed; other varieties are cold-pressed to obtain a first flow, and the residual meal is heated to induce a further flow.

We next visit the part of the Works devoted to the SOLVENT PROCESS of extraction. The fine plant installed here consists of a series of metal tanks called "extractors," with feed pipes for solvent and discharge pipes leading to stills. Meal from the crushing machines is automatically measured into the extractors, whose lids are mechanically removed and replaced; solvent is introduced to dissolve the oil, and the solution of oil is heated in stills. The solvent is distilled off by the action of direct steam, leaving a rich crude oil ready to be pumped into storage tanks. The residual meal is also steam-treated for the complete elimination of the solvent, and is then ready to be used as cattle food. As a higher percentage of oil is extracted by this process than by expression, naturally the residual meal is not quite so rich in that constituent.

Several solvents are suitable for vegetable oil extraction, and are respectively employed according to availability of supplies, market prices, and a manufacturer's individual preference. They include, for instance, benzol, trichlorethylene and petroleum spirit.

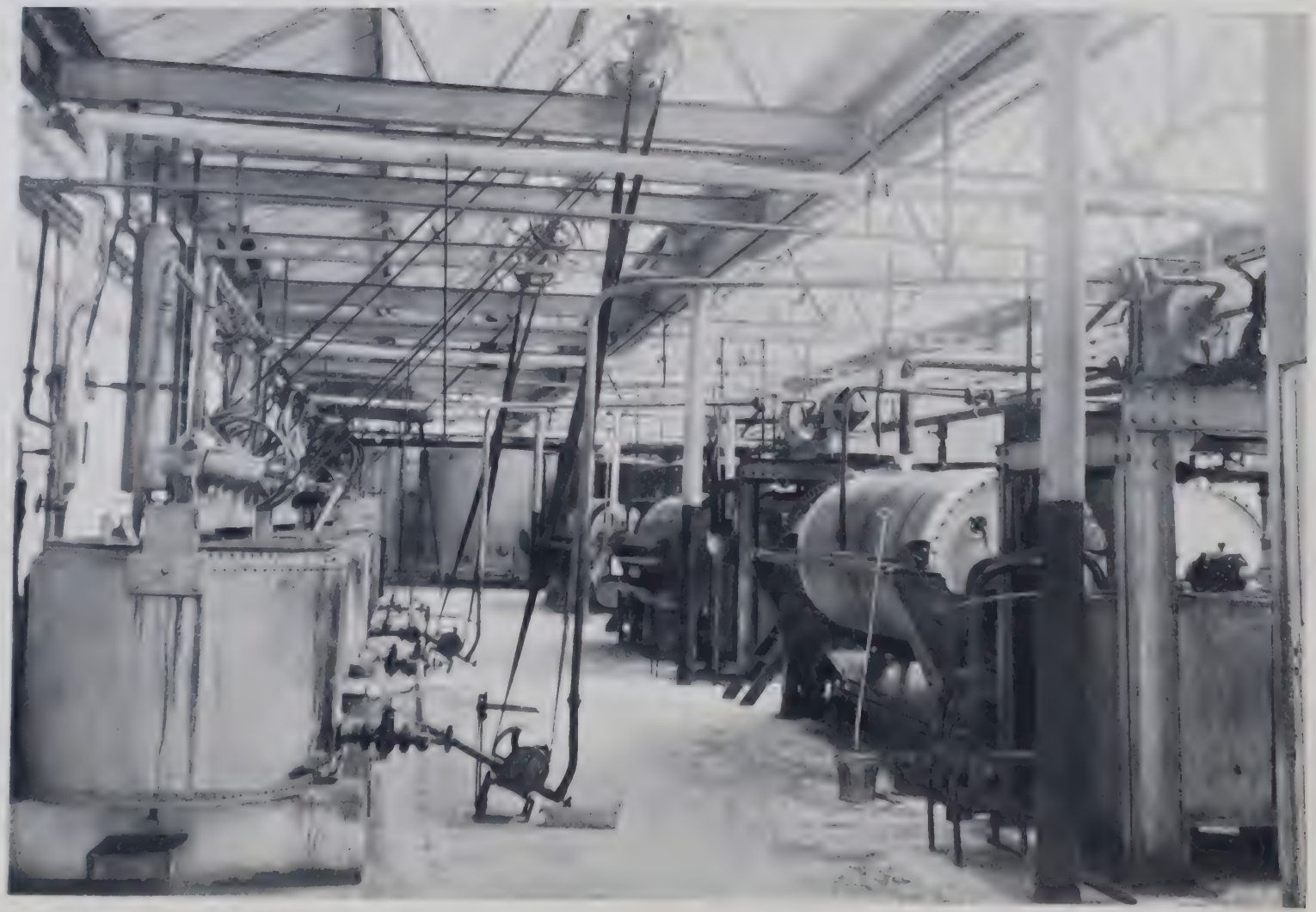
In factories where non-edible oil-seeds are treated, the residual cake and meal, obtained respectively by

the expression and solvent processes, have a commerical value as fertilizers.

We pass on to the Refinery. Edible oils and fats are being treated in this branch of the Works under conditions that enable us to appreciate what is meant by thorough refining.

Vegetable oils are, as you know, naturally a mixture of "glycerides"—that is, compounds of free fatty acids and glycerine. It happens that through the influence of natural agents such as moulds, etc., in the presence of moisture during storage, a certain proportion of these glycerides break up into glycerine and free fatty acids. The preponderance of such free fatty acids is of no great moment to the soap manufacturer, as he immediately proceeds to complete the breaking down of the oil into glycerine and fatty acids by the use of alkalies, so forming a compound of free fatty acids and alkali which produces the basis of soap, the glycerine being run off and recovered.

In the case of oils for edible purposes, it is important that the natural breaking down and production of the free fatty acids should not have passed beyond the initial stages, as otherwise the oil would be of no great value for such purposes. Even the small percentage of free fatty acids, however, must always be removed completely as an initial stage of edible oil refining, as these free fatty acids have a most disagreeable taste and smell. Consequently, in the first stage of refining, we see caustic soda being added to crude oil, with the free fatty acids of which it combines to form a flocculent soap. The soap mixture settles at the bottom of the refining vessel and is drawn off. The neutralized oil is now filtered, washed, and bleached with the help of



BAKERY FATS DEPARTMENT, RAFFINERIES DU CONGO BELGE.

charcoal or Fuller's earth, etc. Finally, the clear, colourless oil is entirely freed from taste and smell by the agency of superheated steam.

The Raffineries du Congo Belge not only extract and refine edible oils, but specialize in the manufacture of bakery fats, which have a wide popularity in the trade under the names of "Deb" and "Flex." Control of quality is maintained in all branches of the Works by the use of superior raw materials and by laboratory tests throughout every stage of each process connected with the output.

The European seed-crushing industry was very seriously dislocated by the outbreak of the War, largely owing to the fact that Germany had become a leading centre of the industry and the principal centre for crushing palm kernels. Great Britain and the tropical countries of the British Empire were particularly badly hit, for Germany had hitherto been the biggest customer for British supplies of copra and palm kernels. Not only did tropical British colonies suddenly find themselves with vast, unmarketable supplies of oil-seeds and nuts on their hands, but the Mother Country discovered she was practically destitute of means for making good the butter shortage, owing to having depended on Germany and Austria-Hungary to extract edible oils from British-produced raw materials, and on these and other European countries to make margarine with that oil. Under the lash of necessity, England rapidly developed her oil-seed extraction industry; new mills were opened in various parts of the country, and plant was installed for the extraction of oil from palm kernels, copra and ground nuts, those highly important edible sources of supply

which had hitherto been neglected by British mills. Hull, the foremost British centre of oil-seed crushing in pre-war days, took the lead in war-time developments, and has now become the premier world-centre of the industry. France, which was Germany's strongest pre-war competitor, has maintained a powerful position, and Marseilles, the French centre, now competes with Hull for supremacy. Holland, Denmark, and Italy have remained important oil-seed crushers, and operations have been actively re-started in Hamburg, the German centre.

## CHAPTER XVII

### WE SEE HOW MARGARINE IS MADE

MARGARINE is no longer looked down upon as the poor man's makeshift for butter. Class prejudice against it was swept away by the War. People who had hitherto bought it when no one they knew was looking, took the habit of purchasing it openly; all who had to choose between tasting it for the first time or going short of fat, chose what they thought was the lesser evil and found, to their surprise, it was a good, wholesome, nutritious food.

By courtesy of the management we have come to see how margarine is made by Planters Margarine Company at their factory in Cheshire. We approach our destination by roads that run through wide open spaces, wherein pretty cottages are dotted among gardens, meadows, and cornfields. Amidst these clean, cheery surroundings, the factory comes into view fronting a wide reach of the Mersey known as Bromboro Port.

Under the guidance of the Works Manager we start our tour of the factory at the POWER HOUSE. Here we see the motors which generate electric power for driving all the machinery throughout the Works, and current for light. There is also an engine which raises the requisite water supply from an artesian well and pumps it to a storage tank for circulation throughout the factory. Here, too, is housed a gigantic plant which compresses ammonia for producing the low temperature requisite for solidifying the emulsion of milk and fats, and for cold storage. Near by, we make the acquaintance of a railway engine with a smokeless boiler, designed to shunt trucks without emitting smuts.

Next we find ourselves on the RECEIVING PLATFORMS of the factory's private railway siding. Milk cans are standing under shelter. Milk comes in from Cheshire farms twice daily. Every can is examined to see that the contents are sweet, clean and unadulterated. When passed, the milk is emptied into a 1,000-gallon aluminium tank, to be pumped up to the dairy. All empties are mechanically washed in a trough fitted with revolving brushes, well rinsed, and sterilized by steam. Barrels of oils and fats are occupying platform space whilst awaiting removal to the store close by.

Crossing over to the RAW MATERIALS STORE, we step into the midst of an army of barrels, containing raw materials such as ground-nut oil, cotton-seed oil, coconut oil, palm-kernel oil and oleo-oil. Oleo-oil is prepared beef fat. All oils come to these Works ready refined. The contents of every cask are examined to see that they are clean, sweet and neutral, and they also undergo a tasting test.

An upstairs journey brings us to the spotlessly clean DAIRY. Here the milk is sterilized and separated in centrifugal separators. Oils and fats are presently going to be added in place of the cream taken away, but first the milk is inoculated with a specially prepared culture of bacteria, which imparts a butter-like flavour and aroma.

The prepared milk is pumped to the emulsifiers. To watch it being fed to them, we pass on to a two-storied department. The upper floor is a platform covering about three-quarters of the area of the spacious room, flanked on its precipice side by a continuous row of hoppers which connect with store tanks on the floor below. All the oils and fats which are to constitute a mixture according to a special margarine recipe are carefully weighed on the platform. The liquid oils are conveyed belowstairs to the tanks by pumps. The solid fats are turned out of their barrels, scraped free of any tub-marks, and mechanically shredded with lightning rapidity into the hoppers, *en route* to the tanks below. We go down to see what is happening in the big tanks, and find that the oils and fats which have been blended for producing margarine of specially good taste and texture, together with a small proportion of colouring matter, are being gently stirred by revolving blades within large capacity receptacles, that are surrounded by a heated jacket. When the heat and the blades have thoroughly well done their work of mixing, the contents of each tank are tested by a scientist to see that they are biologically clean. The assembled oils are pumped to an emulsifier, and at the same time that they enter a little closed vessel by one pipe, milk from the dairy flows into the same

receptacle by another pipe alongside; revolving blades within this vessel bring about a cream-like mingling of oils and milk, which is called an emulsion.

The emulsion travels by pipe lines to the COOLING ROOM. Cooling down is effected by means of large refrigerator drums, containing brine which lowers the temperature to well below freezing-point. So cold are these drums that the moisture accumulated on their fittings is in the form of a thick coat of snow. The emulsion trickles down through a comb-like feeder on to the surface of the drums, solidifies, and is taken off by a fixed knife. The solidified margarine, now in the form of wafer-thin flakes, drops down into wagons.

At various stages of the manufacturing process, the margarine is left to mature; also, it has to pass laboratory tests based on a high standard of taste, aroma, texture and chemical purity.

We next visit the KNEADING DEPARTMENT. Wagon-loads of matured, flaky margarine are run in here to be transferred to rotary vessels, which knead the flakes into a well-worked mass. Kneading operations are controlled by a second-clock, and at the appointed second each vessel is opened for its contents to be transferred down a sloping board back to the wagons.

The final manufacturing operation is carried out in the BLENDING ROOM. Here, bulking and blending are effected in rotary vessels, and at this stage salt is incorporated. The margarine is now ready for packing.

In the PACKING ROOMS men weigh out the margarine and transfer it between big wooden pats into 28-lb. cases; girls superintend machines which make the margarine into 1-lb. and $\frac{1}{2}$-lb. rolls, wrap the rolls in grease-proof paper and put the packed rolls into wooden cases.

Never have we seen any workroom more admirably and tastefully fitted for its purpose than the Girls' Packing Room at this factory, with its pale green glass-lined walls and black and white marble-topped benches. We are specially impressed, too, by the ventilation system which has been installed throughout the factory; all windows are kept shut to exclude dust, fresh air being let in through ducts after it has been purified by a special installation on the roof.

After being nailed down by machinery, the packing cases go to the COLD STORAGE ROOMS, pass out very quickly to the SHIPPING ROOMS, from which they are transferred on electric trucks to trains waiting alongside the DESPATCH PLATFORMS of the factory's railway siding.

Planters' specialities include Table Margarine, under the well-known names of Silver Tray and Welcome Rolls; Pastry Margarine, Cake Margarine, and Compound Lard.

Margarine for making pastry, particularly puff pastry, must have a high melting-point, so that it does not become oily when cook is working it in with the dough. The quality of cake-making margarine depends on its creaming capacity; the higher the creaming capacity, the more eggs can be mixed with it to enrich the cake. Compound lard is a 100 per cent. mixture of fats—in other words, this bakery fat is made in the same way as margarine without the addition of milk.

The factory we have been visiting is open to inspection by the public, and provided for this purpose with a visitors' gallery, which runs throughout the entire Works.

## CHAPTER XVIII

### TALES TOLD BY SUNLIGHT

LESS than forty years ago—in 1886 to be exact—a young Lancashire man, by name William Hesketh Lever, started a little soap-making factory in Warrington. He called his soap "Sunlight," and so the tale began.

The factory was built to turn out 20 tons of Sunlight a week. Within a year it had been enlarged to meet a demand that had risen to 450 tons a week. By this time coming events were casting a very bright shadow before them. The founder and his partner-brother saw that the Warrington site was not big enough for the necessary factory expansion to meet the continuous growth of orders; and they were particularly pleased with such success because it gave them an opportunity of beginning to make other dreams of theirs come true. Now they could see their way to founding a model village, with healthy, cheery housing accommodation for their employees, and in those days people who thought model dwellings should be a feature of factory development were sometimes called pioneers, and more often dubbed as near relations to the Mad Hatter.

A new site was spotted out, in the neighbourhood of Bromborough Pool, a tidal arm of the Mersey on the Cheshire bank of the river, some three miles from Birkenhead and opposite Garston Docks, Liverpool. It was finely situated from the commercial standpoint, as there were river and railway facilities at hand for the arrival of raw materials and the despatch of manufactured products, and at no great distance away there

were populous centres from which to obtain labour. It was equally well situated, too, for the growth of a model village, being in a rural district, well beyond the bounds of slumlands.

Mr. Lever, now Viscount Leverhulme, named the new site PORT SUNLIGHT. The first sod was cut by his late wife, on March 3, 1888, on the plot where No. 1 Soapery now stands.

Port Sunlight village and works originally occupied 56 acres of land. The first factory built there was designed and equipped to turn out 800 tons of soap a week.

By 1894, when the business was transformed into the present Company of Lever Brothers, Limited, the village and works had together grown to an area size of 86 acres.

To-day, Port Sunlight covers a total area of about 550 acres, practically divided equally between:

(*a*) The Works.

(*b*) The self-contained Village of model dwellings, shops, schools, playing fields, and public buildings.

We have come to Port Sunlight, the world-famous centre of the soap industry, for the special purpose of seeing how soap is made. A programme has been very kindly arranged for us accordingly. First we are to visit the Works; afterwards, in the little spare time left before we must break up our party, we are to have a peep at home and social life in the neighbouring Village.

Included in the Works area are four Soaperies, Oil and Cake Mills, Glycerine Factory, Alkali Works, Printing Works, Carpenters' Shops, Engineering Repair Shops, Wharves, Docks, Warehouses, Roads, Railway Sidings, and the Head Offices of the Company.

PLANTERS' DRUM-COOLING ROOM.

The principal RAW MATERIALS used for soap-making are Vegetable Oils, Tallow, Resin, and Caustic Alkali.

The chief varieties of *vegetable oils* employed for soap production are, as we know, palm oil, palm-kernel oil, ground-nut oil, coconut oil, cotton-seed oil, olive oil, linseed oil, sesame oil and soya bean oil; further, aromatic oils of vegetable origin, such as oil of lavender, are utilized for imparting sweet scents to batches of soap that are to be perfumed.

*Tallow* is beef or mutton fat prepared by a process of "rendering," which is to say, separation from the animal tissues by melting. In days not long gone by, rendering was done over an open fire and was a nasty-smelling operation; now it is performed by a vacuum process with steam heat, and has thus ceased to be a public nuisance. The principal sources of tallow supply are the North American, Argentine, and Australian cattle ranches.

*Resin*, often called Rosin, is an ingredient of the natural product known as crude turpentine, which exudes from pine trees. When treated by a process of distillation, crude turpentine yields oil of turpentine, with resin as a residue. Resin is a soap-making fat, specially useful for increasing the lathering power of soap.

Our curiosity as regards *Caustic Alkali* will be satisfied presently; suffice for the moment to know that Soda and Potash are necessary to the production thereof.

We see vast quantities of these numerous varieties of raw materials, or the products from which they can be obtained, arriving at Port Sunlight by barges and goods trains. As we watch barrels of palm oil and bags of palm kernels being unloaded, memory takes

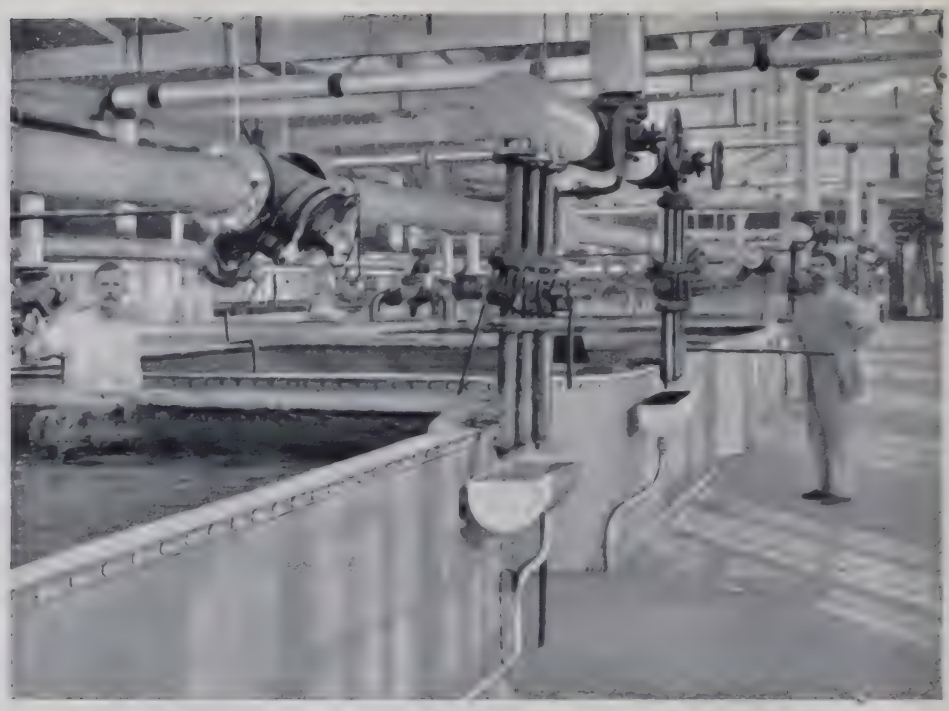
us back to the palm areas of the Huileries du Congo Belge; once again we see natives climbing oil-palm trees, travel on the fruit train to the Alberta mills on the shores of the Congo, watch palm oil being extracted from the fruit pulp, marvel at the rapidity with which the darkies crack the nuts, hear the whistle of the steamers that go a-fetching and a-carrying up and down the river. We are called back from dreamland by other arrival scenes at Port Sunlight—consignments of copra are being taken ashore after their long journey from the Lever coconut plantations in the British Solomon Islands; ground nuts are arriving from Kano, casks of olive oil from Northern Africa, barrels of cotton-seed oil from the States, barrels of ready-rendered tallow from the Argentine.

Ready-extracted oils and fats are transported to warehouses alongside the Soaperies.

Oil-seeds and nuts go to the Oil and Cake Mills. Here we see oil being extracted by the expression and solvent processes. Through our visit to the Raffineries du Congo Belge we are familiar with the operations carried on in this branch of the Sunlight Works, and with the resulting by-products, cattle cake and meal.

In the Alkali Works we are introduced to the chemical side of soap-making. Soda and Potash, when brought into contact with oils and fats (other than essential and mineral oils), liberate fatty acids and combine with them to form a new product, Soap. The combination brought about by the influence of soda is hard soap, and that resulting from the influence of potash is soft soap.

We watch the preparation of soda for its work of soap production. A solution is made, called " Caustic



(*a*) SOAP BOILING AT PORT SUNLIGHT.

(*b*) SOAP CUTTING AT PORT SUNLIGHT.

"Soda Lye," which is a colourless, alkaline liquid that looks very much like water. To see this lye performing the chemical feat known as saponification we go over to the Soaperies.

## CHAPTER XIX

### TALES TOLD BY SUNLIGHT (*continued*)

THERE are now four Soaperies, which is to say, soap-making factories, included in the Port Sunlight Works. So extensive is their area and so up-to-date their equipment, that together they afford facilities for the making of about 4,000 tons of soap at a time, and for the simultaneous cutting and packing of an equally vast total.

In going over one of these Soaperies, the first scene of operations we visit is the BOILING ROOM. Here our attention is at once attracted by gigantic square pans, each having a capacity for boiling 60 tons of soap. Eager to see what is going on in the pans, we make a bee-line for their immediate neighbourhood. Upon arriving alongside them, we are delighted to hear that we may mount a surrounding platform, the special reserve of the highly skilled soap-boilers in charge of operations. From this vantage point we get a fascinating object-lesson in soap-making by keeping our eyes fixed on one pan, and listening to some simple explanations.

The contents of the pan consist of calculated portions of oils and melted fats, which have been run in from store tanks, together with a specially relative portion of caustic soda lye. These are boiled together

by steam heat. The result, in the interesting stage at which we see the boiling, is a mass of soap, formed by the action of caustic soda on the oils and fats; and the simultaneous production of a liquid which contains glycerine and other unsaponifiable matters. The time has come for separating the soapy mass from the liquid; common salt is thrown into the pan, with the result that the soap rises to the surface in the form of a curd, whilst the liquid containing glycerine, together with all impurities, is left at the bottom of the pan. The spent lyes are drawn off. The curd, after being thoroughly tested for purity, is run into iron cooling frames.

In the Cooling Rooms we see a multitude of these giant frames, the ends and sides of which are held together by clamps to keep the soap within bounds. In about five or six days the soap has set; the frames are then opened, and from each of them is released a great block of "Sunlight," weighing about 15 cwt.

In the Cutting and Packing Rooms a variety of machines and countless nimble-fingered girls seem to be competing with each other in the rapidity and efficiency of their movements. The huge blocks of soap are first cut into slabs of the required thickness, by machines fitted with parallel wires. The slabs are re-cut by other machines into bars. The bars are then piled up across each other so that the air can freely circulate round about them; after being left for a day or two to dry, they are cut into shorter bars of the well-known length of Sunlight tablets. These short bars are next put through a stamping machine, which bestows on them their world-famous name and purity guarantee, and impresses them with the dividing line

that completes their transformation into Siamese-twin tablets.

The stamped tablets come pouring out of the stamping machines in a continuous stream, and are automatically carried by non-stop conveyers to rows of girls, who are on the alert to pounce upon them and fold them in printed wrappers. The wrapped tablets are put in cartons, which travel by a rotary railway to men packers, who rapidly dispose of them in wooden cases ready for their journey to shops and stores.

Toilet soap is prepared from special blends of raw materials in a similar way to laundry and household soaps, up to the boiling stage. Subsequently, it is carefully flaked by machinery and dried; colouring matter and sweet-scented oil are added to the dried flakes. The shredded soap, colouring matter and perfume are mixed together by machinery, and the mixture is passed through another machine, from which it emerges, through a cylindrical tube, in the form of a solid bar. The bars are machine-cut into small blocks, and each block goes into a mould, where it is stamped into the shape of a round or oblong cake, and impressed with its own distinctive name.

There are numerous details in soap-making which call for expert attention. Thus, in the process of saponification, an excess of alkali would produce soap injurious to the skin of anyone using it, and to the fabric of garments washed with it. The purity and quality of soap depend, therefore, not only on the nature of raw materials used, but on the skill and care with which they are treated during the various processes of manufacture.

During our visit to the Sunlight Soaperies we glean

many a hint of high-standard efficiency methods for transforming good materials into good soap, as, for instance, repeated laboratory tests for purity and the use of up-to-date equipment under the supervision of a highly trained staff.

Between trolley-loads of packing-cases filled with "Sunlight," "Lifebuoy," and "Lux," we are piloted through warehouses to the GLYCERINE WORKS. Here glycerine is recovered from the spent lyes which are drawn off from the soap-boiling pans. Various impurities are removed by chemical treatment and by evaporation, and the liquid left is "Crude Glycerine," which resembles treacle in colour and consistency. By distillation, crude glycerine yields a more or less pure product, of a pale straw colour, which is used for the manufacture of nitro-glycerine for dynamite. Redistillation produces the pure, colourless glycerine, so valuable for numerous domestic and medicinal purposes.

A few minutes' walk from the hive of industry included in the Works area brings us into the quiet, cheery atmosphere of Port Sunlight Village. There are no artificial boundaries between the Village and the Works. Each completes the other, both being vital parts of one great industrial organization. They were conceived together, they were founded together, and together they have grown up as helpmates.

Port Sunlight Village was built out of the profits of the business as the business prospered, and all its house, home, and communal advantages are reserved to the workers who have contributed to such prosperity. The houses are let at rents arranged under a system of prosperity-sharing, the amount charged being below the cost of upkeep and repair; they are

STACKS OF SOAP AT PORT SUNLIGHT.

mainly of two types, the kitchen cottage and the parlour house, and each has a bathroom, with the added luxury of a garden. The whole of the buildings harmonize into an individual style of rural architecture that is reposeful in its uniformity and picturesque in its wide variety of detail. Easy, safe, and pleasant means of communication are provided by wide roads lined with trees and flanked by broad footpaths. Large open spaces, well-equipped sports grounds and numerous public buildings afford facilities for recreation, social intercourse and educational advantages. The latest addition to such opportunities for enjoying life in this garden city is the Hulme Art Gallery (Lady Lever Memorial); rare and valuable art treasures of all kinds are already housed here, and the collection is constantly being enriched by the generosity of the founder.

* * * * *

When we started out on our trip together, little did you imagine, I presume, that our interest in vegetable oils would bring us to an Art Gallery. It happens that in such undreamed-of surroundings our tour finishes, for we are skirting the extreme bounds of our holiday time-limit. In the moments of *au revoir*, I would like to remind you that even by coming amidst art treasures we have not left the direct track of our quest. Paints and varnishes are essential to the execution of many an artist-craftsman's creations, such as gems of furniture, frames worthy of inspired pictures, and new " coats " for preserving the colour and texture of Old Masters.

I would remind you, too, that vegetable oils took a leading part in helping the Allies win the War; abun-

dant sources of supply in the British, French, and Belgian colonies furnished raw materials for the production of nitro-glycerine, used in munition factories. As a further hint regarding the infinite scope of service performed by vegetable oils, I would ask you to think over, after we have parted, the peace work of dynamite, which is made with nitro-glycerine of vegetable-oil origin—its importance in the development of such great industries as mining and quarrying, and in blasting operations for such progressive enterprises as the cutting of the Panama Canal.

As a last word of thanks to you for the happy time I have spent with you on this trip, may I hope that when you next wash your hands, buy margarine, or put a night-light in the nursery, memory will conjure up sunny pictures of the scenes we have visited, and kind thoughts of the friends we have met.

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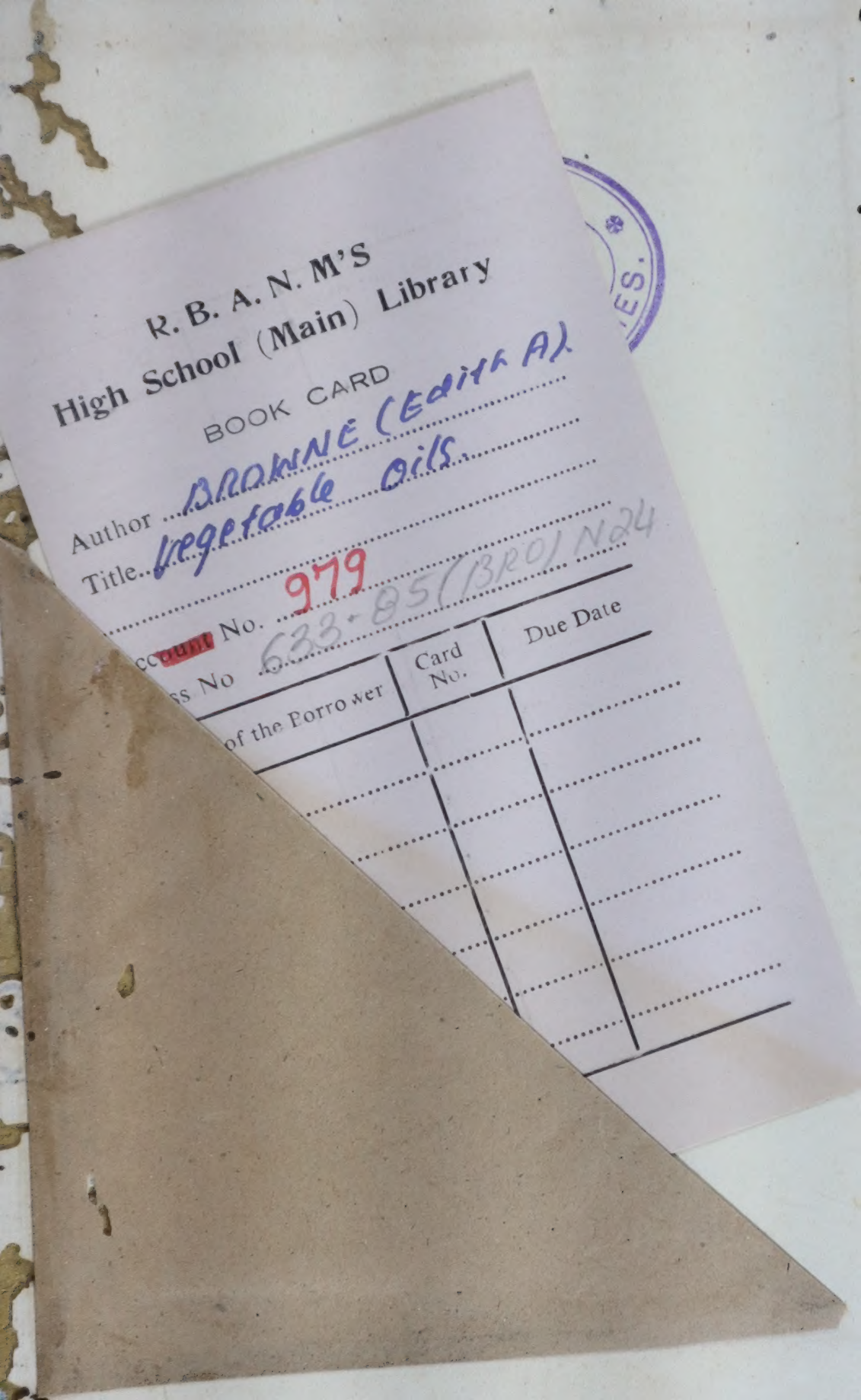

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